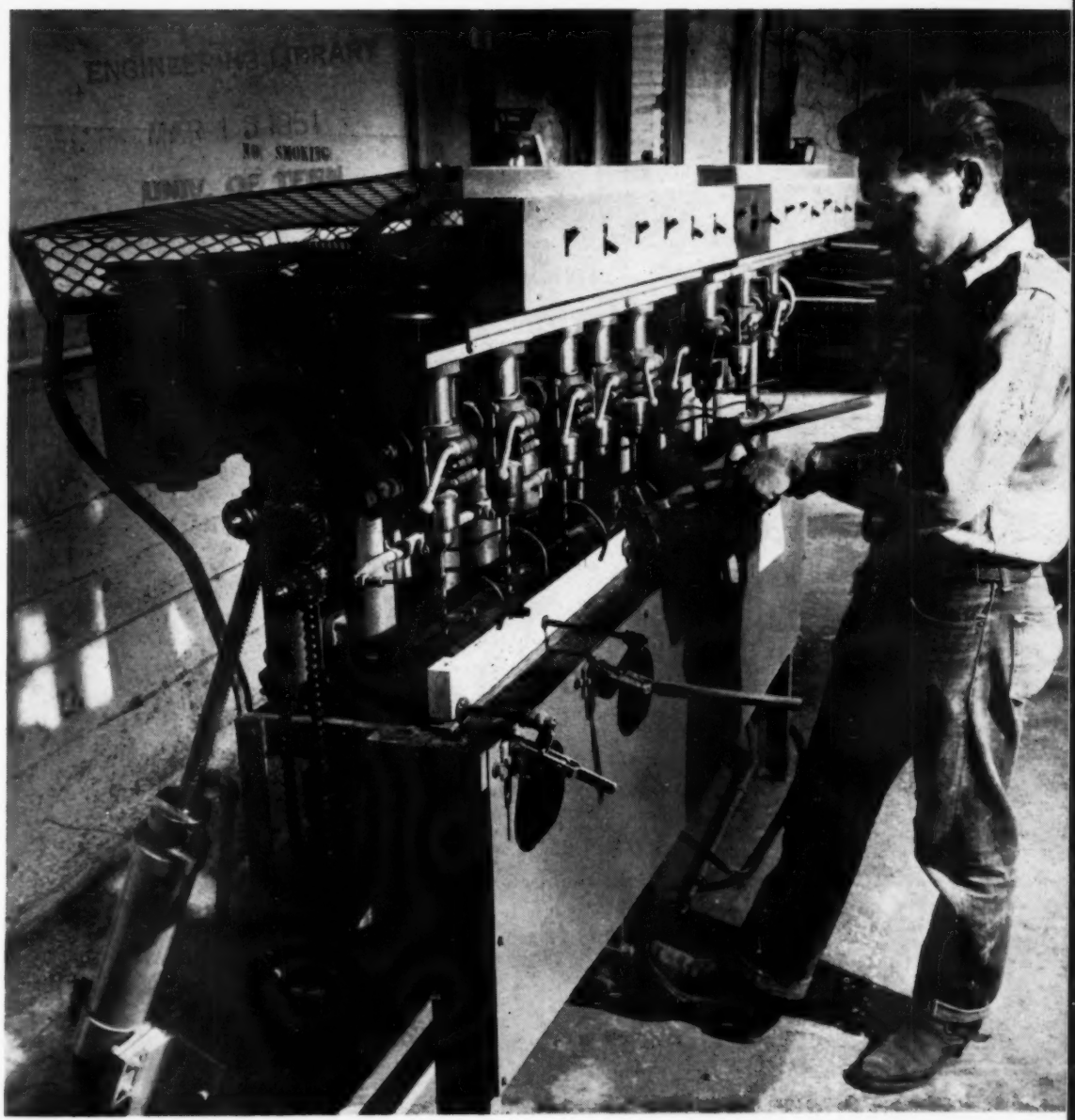
# APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

MARCH, 1951

- HYDRAULIC CIRCUITS
- HYDRAULIC CONTROLS
- AIR CIRCUITS
- AIR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

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EFFICIENT PUMP TESTING WITH HYDRAULICALLY OPERATED STANDS

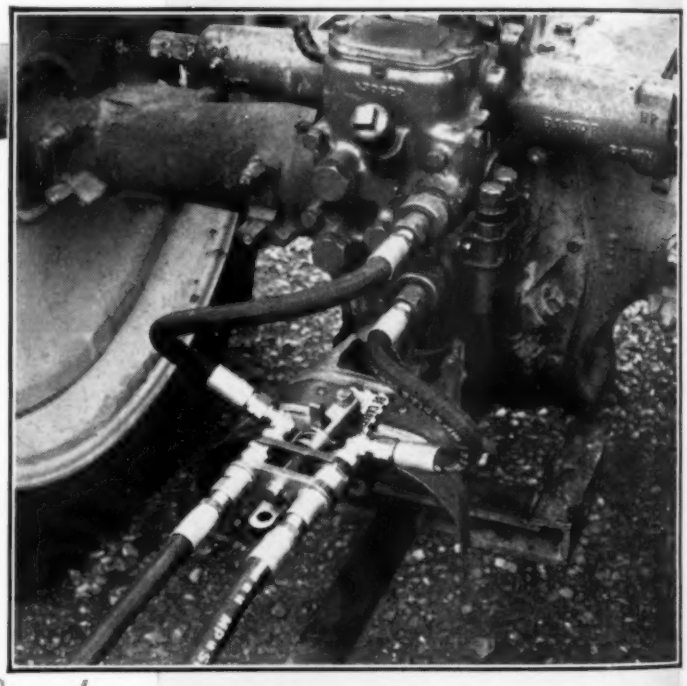
AUTOMATIC CASE UNPACKER

AIR CONVERSION FOR AUTOMATIC CYCLING

# FLEXIBLE HOSE LINES

## WITH DETACHABLE, REUSABLE FITTINGS

**Always first**
**ON FARM EQUIPMENT**



**Save time, save money and reduce inventory by putting the "Aeroquip Idea" to work for you. With Aeroquip you make your own flexible hose assemblies by cutting bulk hose to desired lengths and attaching Aeroquip Reusable Fittings. Assembly can be accomplished quickly and easily right on the job. No special tools are required. No training is needed. Aeroquip high quality Flexible Hose Lines improve performance and reduce maintenance. They eliminate leaks due to vibration and operate dependably at extremely high or low temperatures. They are widely used for hydraulic fluid, water, air, lubricating oils, gas and Diesel fuels and many other fluids.**

Always first

B.D. check into this money saving idea—Jo

**Aeroquip Flexible Hose Assemblies are pictured here connecting the tractor hydraulic system to the pull-behind implement. Connecting the hose lines is the Aeroquip "Breakaway" Coupling which eliminates the breaking of hose lines whenever the implement breaks away from the tractor.**

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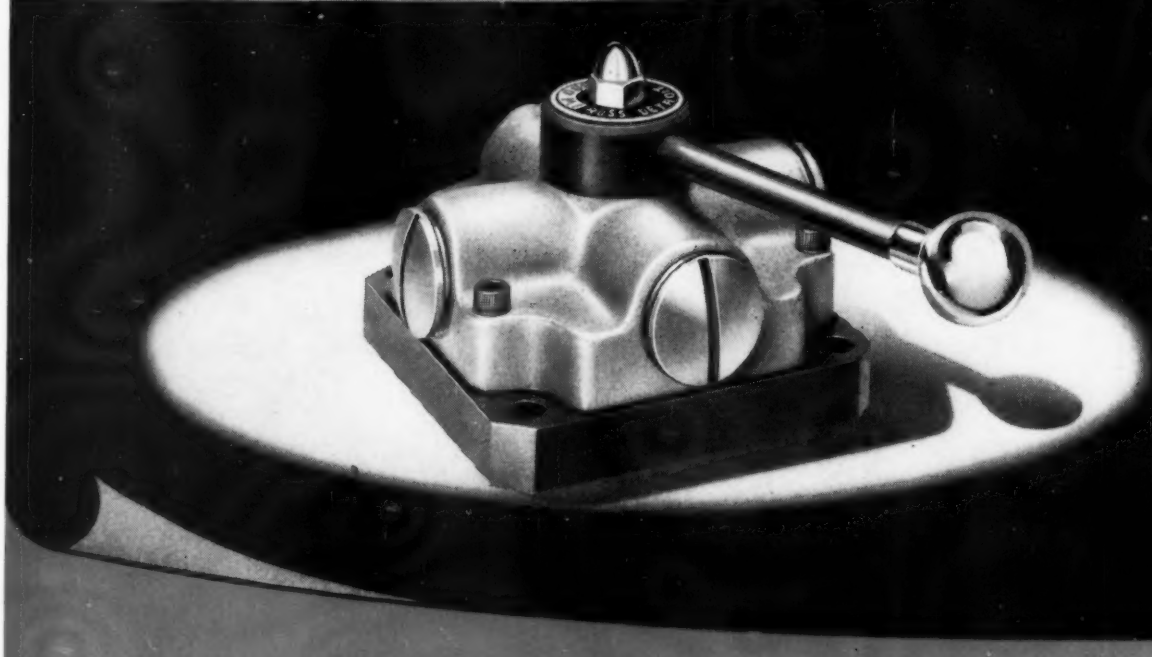

# ROSS Introduces Poppet Valve *with Rotary Handle Action*

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- A 4-way unit available in ¼ and ⅜-inch pipe sizes

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## ROSS OPERATING VALVE COMPANY

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# applied HYDRAULICS

March, 1951 Vol. 4, No. 3



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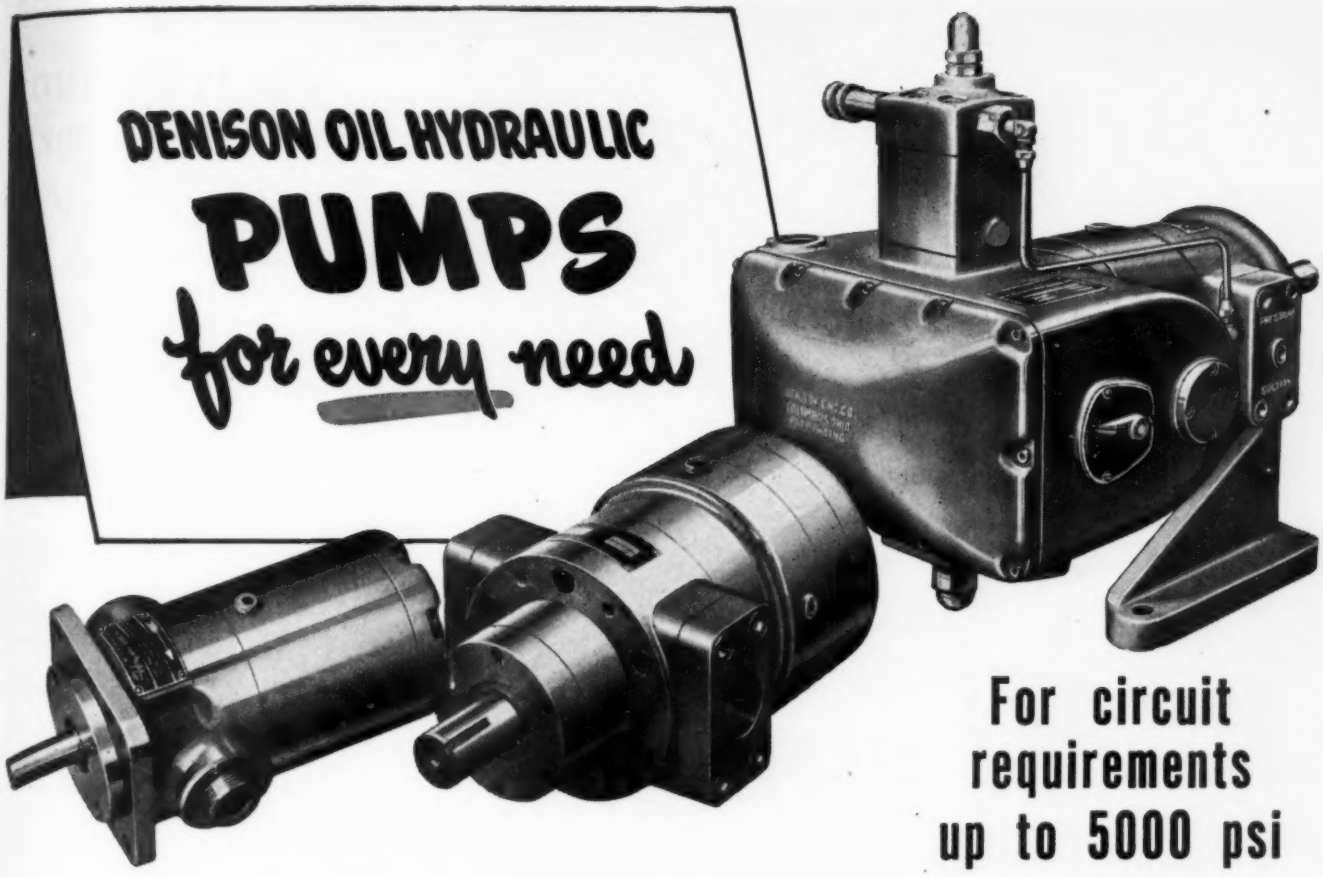
**FRONT COVER: The air cylinder, lower left, supplies the feed drive for up to 14 drills on this operation at Food Machinery Corporation, Riverside, California.**
***Photo Courtesy Compressed Air and Gas Institute***

# DENISON OIL HYDRAULIC PUMPS for every need



## For circuit requirements up to 5000 psi

## Highly efficient on both light aircraft and heavy industrial oils

The extra efficiency of these high-pressure, high-volume pumps is the result of a full quarter century of specialized experience and pioneering research in oil hydraulics, on the part of Denison engineers.

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Users in every field have found that *comparison quickly proves the many advantages of Denison Pumps.* That is why, every year, more and more users insist on Denison Pumps for all types of circuit needs. Write today for full details on Denison's complete line of HydrOILic Pumps.

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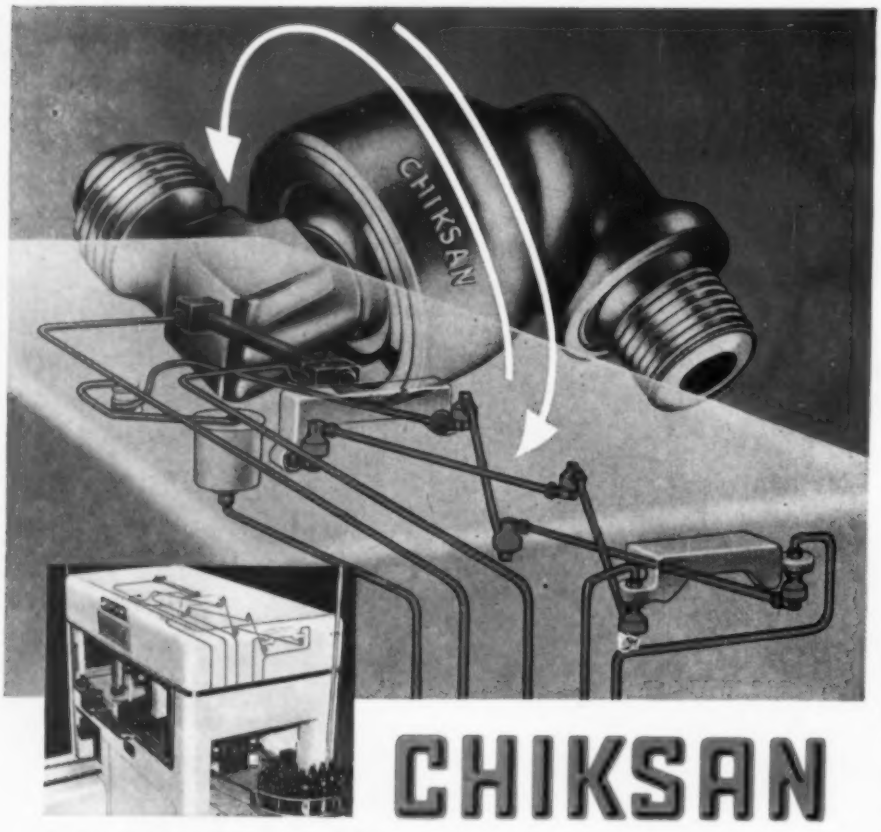
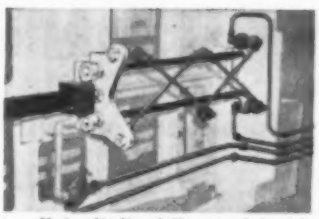
**DENISON HydrOILics**

**The DENISON Engineering Company**
**1166 Dublin Rd. Columbus 16, Ohio**

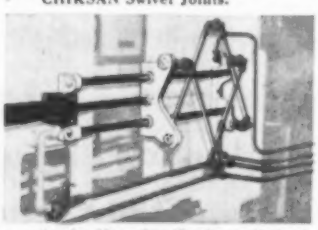



# CHIKSAN

## *Hydraulic Swivel Joints help to simplify design*



Hydraulic line fully extended, with turning movement taking place with CHIKSAN Swivel Joints.



As the Unpacker Head travels back and forth, the hydraulic line folds and unfolds automatically.

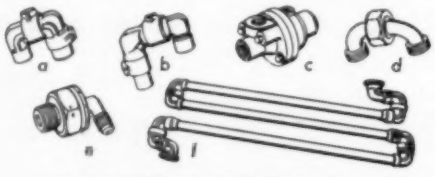
At the end of the stroke, the hydraulic line requires sharp bends which are possible only by using CHIKSAN Swivel Joints.

**With CHIKSAN Hydraulic Swivel Joints you can design and build flexible hydraulic lines to handle pressures to 3,000 psi . . . and thereby gain advantages not obtainable by any other method. A typical example is the *Ermold Automatic Case Unpacker.***

**CHIKSAN Hydraulic Swivel Joints make possible sharp bends, thus permitting installations where space is limited. They eliminate drag and snag. In addition, you get uniform low operating torque, strength and safety under all conditions. All-metal tubing assures longer life.**

**There are 5 Basic Types of CHIKSAN Swivel Joints – a Type for every purpose. CHIKSAN Engineers will gladly cooperate with you in selecting the correct Type . . . either standard or of special design . . . for your specific requirements.**

*(a) Basic Type Swivel Joints – for pressures from 125 psi to 15,000 psi. (b) High Temperature Swivel Joints for temperatures to 500° F., working pressures to 700 psi. (c) Rotating Joints for 150-lb. steam, brine, etc. For hot and cold rolls, tumblers, platens, etc. (d) Sanitary Swivel Joints for food processing, fruit juices, dairies, etc. (e) Hydraulic Swivel Joints for pressures to 3,000 psi. For aircraft, industrial and armored equipment. (f) Flexible Lines, designed and fabricated to meet specific requirements.*

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**BALDWIN DUCKWORTH DIVISION OF CHAIN BELT COMPANY.** "Tension Linkages" are the subject of an informative engineering handbook, Bulletin 51-10.
Circle 61 on Reader Service Card

**FULFLO SPECIALTIES CO., INC.** Their mechanical data book offers detailed drawings and application data on hydraulic valves and coolant pumps.
Circle 64 on Reader Service Card

**THE BELLOWS CO.** Design engineers will find valuable data on pneumatic systems in Bulletin AV-300 and CL-30. Application and construction of components are illustrated.
Circle 19 on Reader Service Card

**CHIKSAN COMPANY** Hydraulic swivel joints which permit the design of flexible lines to handle pressures up to 3000 psi on aircraft and industrial equipment are described in catalog 50-AH.
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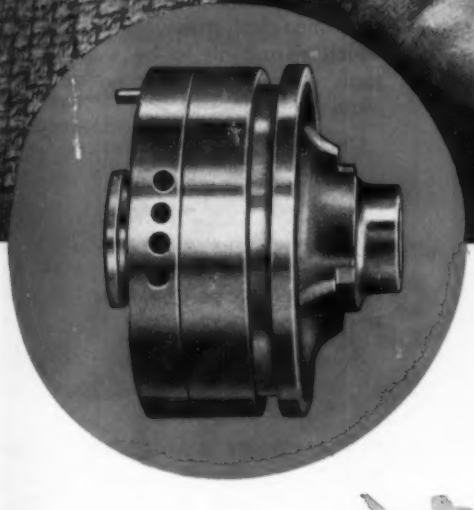
**DENISON ENGINEERING COMPANY** Catalog sheets offer full details on their compact, sturdy axial piston pumps for operating pressures up to 5000 psi and delivery to 35 gpm.
Circle 4 on Reader Service Card

**YOUNG RADIATOR COMPANY** To supply you with facts on fixed and removable tube bundle heat exchangers, two illustrated catalogs are offered.
Circle 68 on Reader Service Card

*(Continued on page 6)*

# Compact new SUNDSTRAND control oil pump developed for high-flying jets



## High speed unit now available for lubrication or hydraulic control applications

You may find use for this patented "Rota-Roll" pumping unit, or an adaptation of it, in your own product designs. The compactness of its concentric design and its favorable high speed characteristics make it possible to fit this pump into an extremely limited space. Success of its original application already has led to adaptations for other purposes, both singly and in series mounting. If you wish data on this pump, or have a puzzling hydraulic problem requiring *reliable* research, *expert* engineering, and *precision* production, come to Sundstrand.

SUNDSTRAND

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GAST MANUFACTURING CO. 26 product problems and solutions which use rotary air pumps are detailed in Gast's "Application Ideas Booklet".

Circle 56 on Reader Service Card

GOSHEN RUBBER CO., INC. Design data, including machining tolerances, squeeze allowance and materials are fully covered in a comprehensive handbook on "O" rings.

Circle 34 on Reader Service Card

HONAN-CRANE CORPORATION An informative bulletin titled "Stop Downtime and Expensive Repairs on Hydraulic Equipment" gives application data on oil purifiers.

Circle 54 on Reader Service Card

C. B. HUNT & SON, INC. Bulletin 104-C gives full details of valve couplings for pressures to 250 psi which permit air to be shut off and tools changed without going to the main shut-off valve.

Circle 44 on Reader Service Card

HYDRAULIC ACCESSORIES CO. Cylinder rod wipers, giving protection from scoring, are detailed in available literature.

Circle 59 on Reader Service Card

LOGANSPORT MACHINE COMPANY INC. For component data, to help build your air and oil circuit, complete catalogs have been prepared. Valves, chucks, cylinders, fittings and power units for both pneumatic and hydraulic service are described.

Circle 57 on Reader Service Card

MILLER MOTOR COMPANY Illustrated cylinder bulletins A-105 and H-104 present construction, application and selection of air and oil cylinders.

Circle 11 on Reader Service Card

M-B PRODUCTS. Literature illustrates the construction and application of their air line filter, regulator and lubricator assembly.

Circle 46 on Reader Service Card

*(Continued on page 70)*

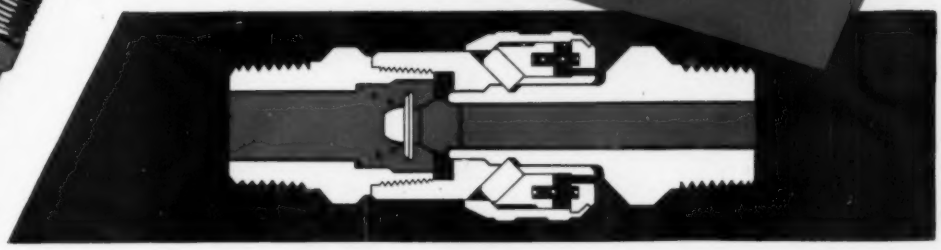
# HANSEN

## QUICK CONNECTIVE SHUT-OFF COUPLINGS

HYDRAULIC • PNEUMATIC

HANSEN PUSH-TITE COUPLING

Cross-section at upper right shows flow through coupling when connected.

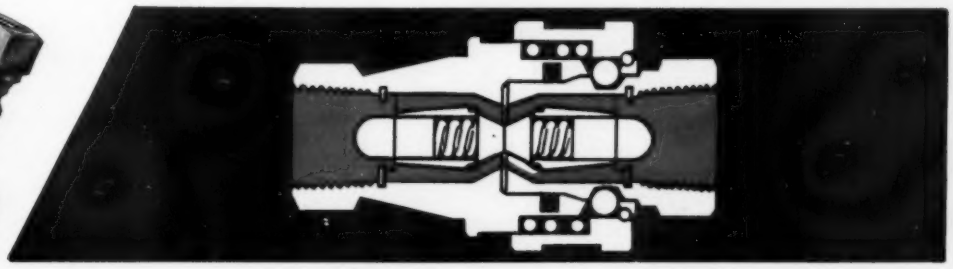


## HANSEN *PUSH*-TITE COUPLING *Shuts off one side of line*

Hansen Push-Tite Couplings give you quick connection and disconnection, with instant automatic flow or shut-off. To connect coupling, and open line to flow of fluid, you merely push plug into socket. To disconnect, a slight pull on sleeve releases plug and shuts off supply end of line. Free swiveling plug prevents hose kinks.

HANSEN SERIES HK

Shuts off both ends of line when disconnected.



## HANSEN *HIGH-PRESSURE 2-WAY Shut-off* COUPLING

To connect, merely pull back sleeve and push plug into socket. Identical torpedo type valves permit free flow of gas or liquid through coupling. To disconnect, just pull back sleeve—coupling immediately disconnects, valves automatically and instantly seal both ends of line. Can be mounted to disconnect automatically where fluid lines may be subject to sudden, damaging strain.

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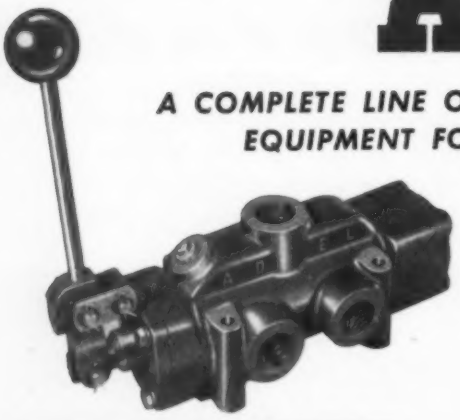
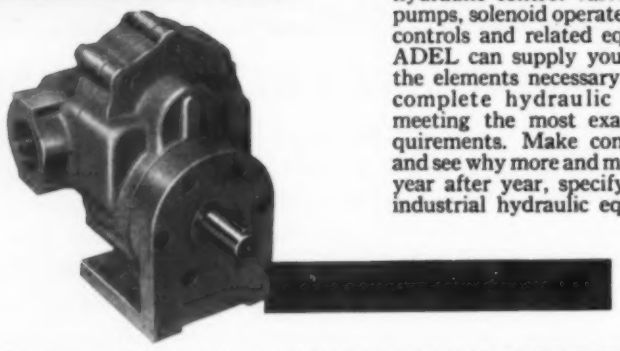
# ADEL

## A COMPLETE LINE OF INDUSTRIAL HYDRAULIC EQUIPMENT FOR EVERY APPLICATION



For fourteen years ADEL has continuously directed its energies to the advanced development and production of high-quality hydraulic equipment. With the most modern facilities in our 150,000 square foot plant, we build ruggedness, efficiency and compactness into each ADEL unit. The variety of equipment being manufactured has been steadily expanded until today it encompasses a complete line of hydraulic control valves, power pumps, solenoid operated remote controls and related equipment. ADEL can supply you with all the elements necessary to build complete hydraulic systems meeting the most exacting requirements. Make comparisons and see why more and more users, year after year, specify ADEL industrial hydraulic equipment.



A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

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# LETTERS to the Editor

Is it possible to obtain either the back issues of your Basic Hydraulic Course that is now being published or can we obtain the complete course in book form?

C.E.B.

*We are not able to furnish back issues, with few exceptions. We have used as the major source in the early chapters a war-time Navy training manual, which is still in print We have deviated somewhat from this source, largely because the material is now becoming obsolescent and beginning with the current chapter on pumps, the material is based entirely on material furnished by manufacturers.*

---

When your magazine APPLIED HYDRAULICS first appeared, we subscribed to it. We continue to receive it and find it very useful. At the end of each year we bind the individual issues into permanent volumes for future reference. In order to make good use of the bound volumes for reference purposes, indexes to the various volumes are quite handy. Do you have indexes for the issues published in 1948 and 1949? We would appreciate having a copy covering the period mentioned.

J.A.M.

*We have mimeographed copies of both title and author indexes of volume 1 and 2 covering 1948 and 1949. Copies have been sent to you. We will have ready by the time you read this title and author indexes to copies published in 1950 as volume 3. Copies will be sent on request.*

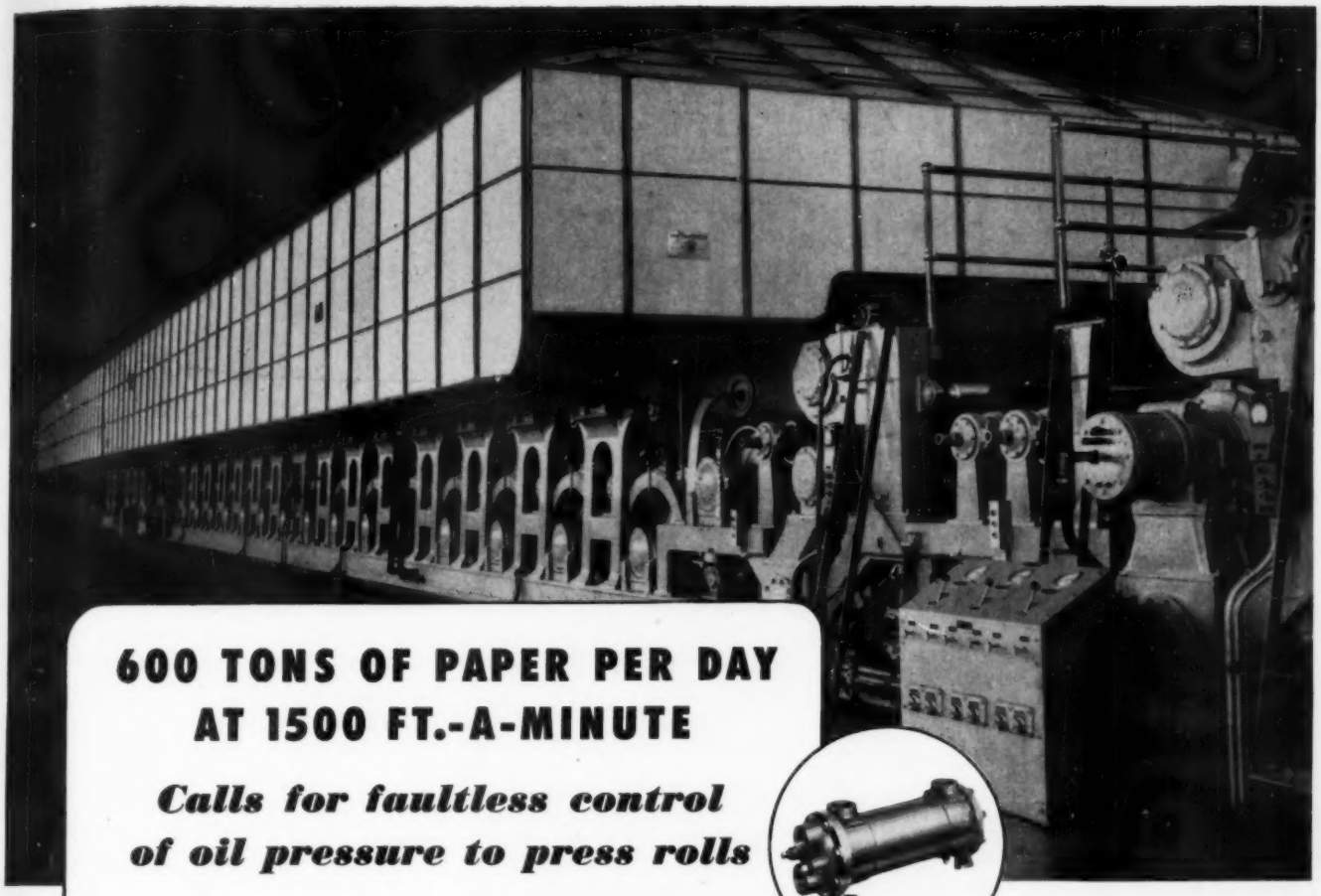
---

Can you tell us which of the papers of the National Conference on Industrial Hydraulics will appear in APPLIED HYDRAULICS?

J.P.

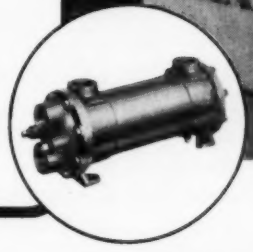
*We cannot answer that question now. We expect to publish sevral, probably abridged or abstracted, and in some cases with summaries of the comments developed by panel*

*(Continued on page 18)*



# 600 TONS OF PAPER PER DAY AT 1500 FT.-A-MINUTE

## *Calls for faultless control of oil pressure to press rolls*



● Extending 300 ft. in length, towering 17 ft. and weighing 3,350,000 lbs., this mammoth Dryer section, only one segment of a complete Rice Barton Corporation paper making machine, is constructed to produce 600 tons of paper per 24-hour day at about 1500 ft.-a-minute clip.

Such round-the-clock production, 7 days a week, leaves no room for "unscheduled" downtime, for an hour's hold-up represents at least 25 tons lost from the daily production rate . . . 25 tons never to be regained.

Vital to the continuous operation of this mill are the Hydraulic Control Panels . . . depended upon for the critical function of controlling the oil pressure ("holding-down" pressure) to the paper machine press rolls. Faulty operation, through excessive hydraulic oil temperature, could well mean tons upon tons of production losses.

Guarding the condition of the hydraulic oil to assure trouble-free operation of these control panels, and accordingly, helping to guard the service reputation of the entire Rice Barton paper machine, are compact Ross Type BCF Exchangers. As small as they are, as relatively minute in cost as they are to the value of the whole machine, they are relied upon for the giant responsibility of maintaining a constant supply of hydraulic oil at most effective temperatures. Otherwise, pump slippage, internal leakage and malfunction of precision-made controls could easily inflict production losses many times the cost of the Ross units.

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FIELD ENGINEER OFFICES IN ALL PRINCIPAL CITIES


## Letters to the Editor

*(Continued from page 14)*

*speakers. We do promise that several papers of most interest to large numbers of our readers will appear.*

---

In visiting a plant recently I noticed that many of the circuit prints had various types of valves, pumps and other hydraulic components stamped on the prints, apparently by a rubber stamp. Can you tell us where such rubber stamps could be obtained?

F.H.

*We do not know, nor have we found anyone that knows of such a manual available for public use. As far as could be determined, no one of the press building companies has issued such information. It is possible that some of the large users of presses, particularly those that might rebuild their presses, might have such information.*

---

I have noticed references to a list of publications, books manuals and data sheets in back issues of APPLIED HYDRAULICS. I would appreciate a copy of this list. Do you know of a course in hydraulics that is given in the Detroit area?

F.E.B.

*A copy of the APPLIED HYDRAULICS Data List has been sent to you and information on at least one training course in the Detroit area that you might be interested in. This does not include training programs which more than one Detroit manufacturer offers to selected personnel of their customers. You can determine within your own company whether you may qualify for the manufacturers' training courses.*

---

*The advertising manager of Caterpillar Tractor Co., W. K. Cox, has called to our attention that in the article "Coal Mining With Oil", published in the November, VTEJ issue, we have referred to "caterpillar tracks" in two places, once in the text and once in a caption. He points out, quite properly, that "Caterpillar" is a registered trademark. He suggests that, since his own company, like that of competitors, refers to such designs as crawler or track-type tracks, that it would be both more accurate and appropriate, to so designate such tracks. We are sorry that this mis-application of a trade name occurred and assure Mr. Cox that we will be more careful of our nomenclature herafter.*

*(Continued on page 23)*

## Letters to the Editor

*(Continued from page 18)*

The names we have given to some of our cylinder parts do not seem to agree, entirely, with some of the other manufacturers. We would like to know if these parts should be given a certain name or if it is up to makers to coin names for them. The part we call the stuffing box, for example, some call the cylinder head or front end plate, etc. The other parts of concern are follower plates, piston plate and packing gland. It seems that cylinders have been made for a long enough time that they would have parts names pretty well standard. Perhaps you can answer that for us.

G.M.

*There are, of course, a number of reasons why the nomenclature of cylinder and other hydraulic parts vary—they are influenced by the nomenclatures current in industries that use them, they follow the training and experience of designers, they vary with different sections of the country and by the major manufacturing interests of a given area. The J.I.C. Hydraulic and Pneumatic Standards for Industrial Equipment, in recognition of this variance, has included a Glossary of Terms in each, as an aid in such standardization. In addition, there are several committees of leading technical societies that are working on this problem.*

### Dollars For Ideas

**Tell us "Here's How" you do it at your plant. Sketch or jot down your labor-saver and send it in to the Editor—It may be worth $10.00 Every item published is worth $5.00, the best-of-the-month $10.00.**

I wonder whether you could put me in touch with any publication which describes step-by-step procedure for building hydraulic presses. What I have in mind is the type of press commonly used in the smaller metalworking shops for a variety of purposes in sizes not exceeding 500 tons capacity.

G.G. MD.

*We can't tell you directly but we are sending you the name of a hydraulic engineer who makes use of rubber stamps to represent hydraulic symbols on his circuit drawings. We feel sure that he will be able to give you this information.*


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Gerotor hydraulic pumps are engineered for pressures up to 1000 p.s.i., continuous duty; in some sizes, up to 1200 p.s.i., continuous, and 1500 p.s.i., intermittent. Deliveries range from .4 g.p.m. at 1800 r.p.m. to 40 g.p.m. at 1200 r.p.m. Plain, base or flange mounting. Models available for two separate circuits. Write for Catalog Sections G-101, G-103, G-104, G-106.

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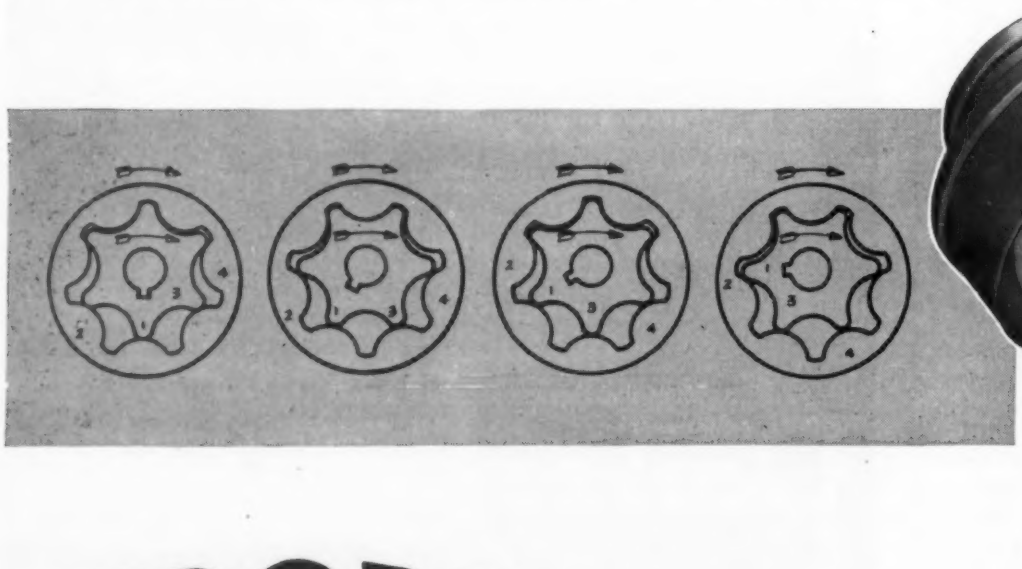
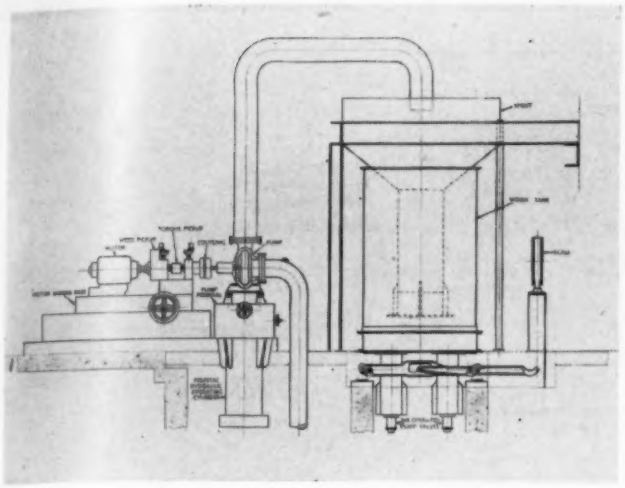
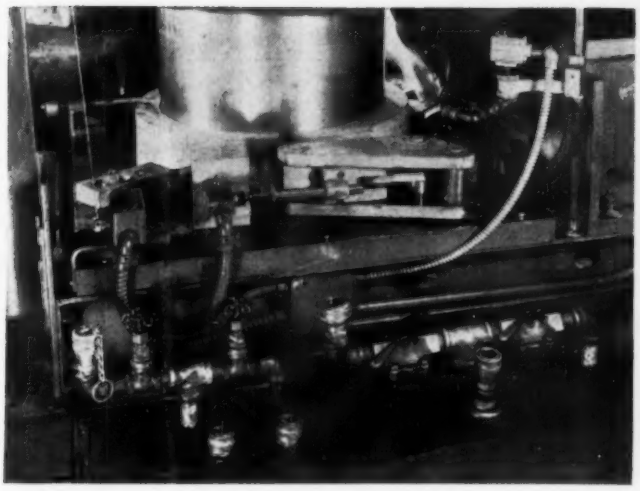


**GEROTOR** hydraulic pumps and motors



Every pump is placed on a test stand to obtain power and capacity measurements. Alignment of pump and motor is quickly accomplished by hydraulic action.



A single acting ram which moves the pump up and down, is clamped by brake shoes which are opened and closed by the movement of a 2 inch diameter cylinder.

# Efficient Pump Testing With Hydraulically Operated Stands

By **NORMAN STEINHAUER**
Tool Engineering Department
Allis-Chalmers Mfg. Co.

THE EXPENDITURE INCURRED IN TESTING CENtrifugal pumps is often a substantial part of the total factory cost. To reduce this cost and to obtain far greater accuracy, Allis-Chalmers has developed modernized pump test facilities.

A substantial portion of the total cost reduction is accomplished by simplifying the set-up procedure. This has been obtained through use of special test stands with hydraulically controlled and actuated platforms that carry the drive motor, speed and torque measuring instruments and the pump being tested. This arrangement allows the operator to line up the driving and measuring portion of the stand with the pump rapidly and accurately. The use of several hand operated control valves to position the equipment replaces laborious and time consuming manual shimming and shifting of pump and motor.

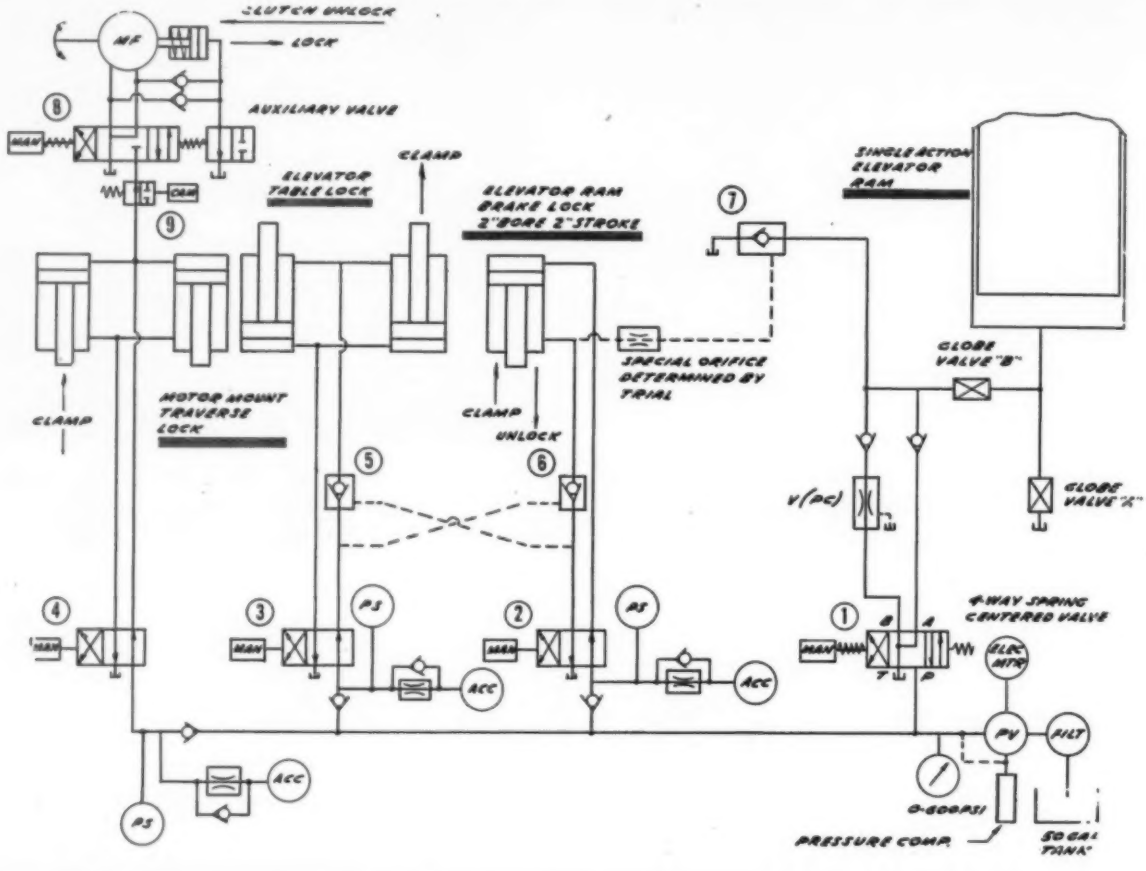
The savings effected through use of such equipment are illustrated by the fact that set-up and test time for medium sized pumps was reduced from four hours per pump to one hour.

Requirements for the stand are as follows:

The pump must be bolted on a platform that can be moved up or down, swung radially or moved back and forth in a motion parallel to the driving unit shaft centerline. All adjustments must be locked when in position.

The driving motor and necessary measuring equipment must be permanently mounted on a platform that can be moved back and forth in a straight line motion and then locked in any desired position.

To meet these requirements, a single acting elevator ram is used to move the pump up or down. A cylinder operated brake band, in addition to trapped oil, locks the position of the ram. A ratchet driven screw attached to the brake band and anchored to a portion of the stationary elevator cylinder provides the required radial movement. This adjustment is locked by two cylinders which clamp lugs on the brake band tightly against the stationary portion of the eleva-




Design of the hydraulic circuit assures proper sequencing of operations. The elevating ram is positioned and then clamped by the brake cylinder. The elevator table is locked and after the fluid motor positions the electric drive motor, cylinder actuated clamps hold the drive platform.

tor cylinder. This will be referred to as the elevator table lock.

The back and forth movement of the platform is accomplished by means of a handwheel and screw arrangement. It is locked by hand operated quick acting cams. Since this adjustment is usually minor, hand actuation is deemed sufficient.

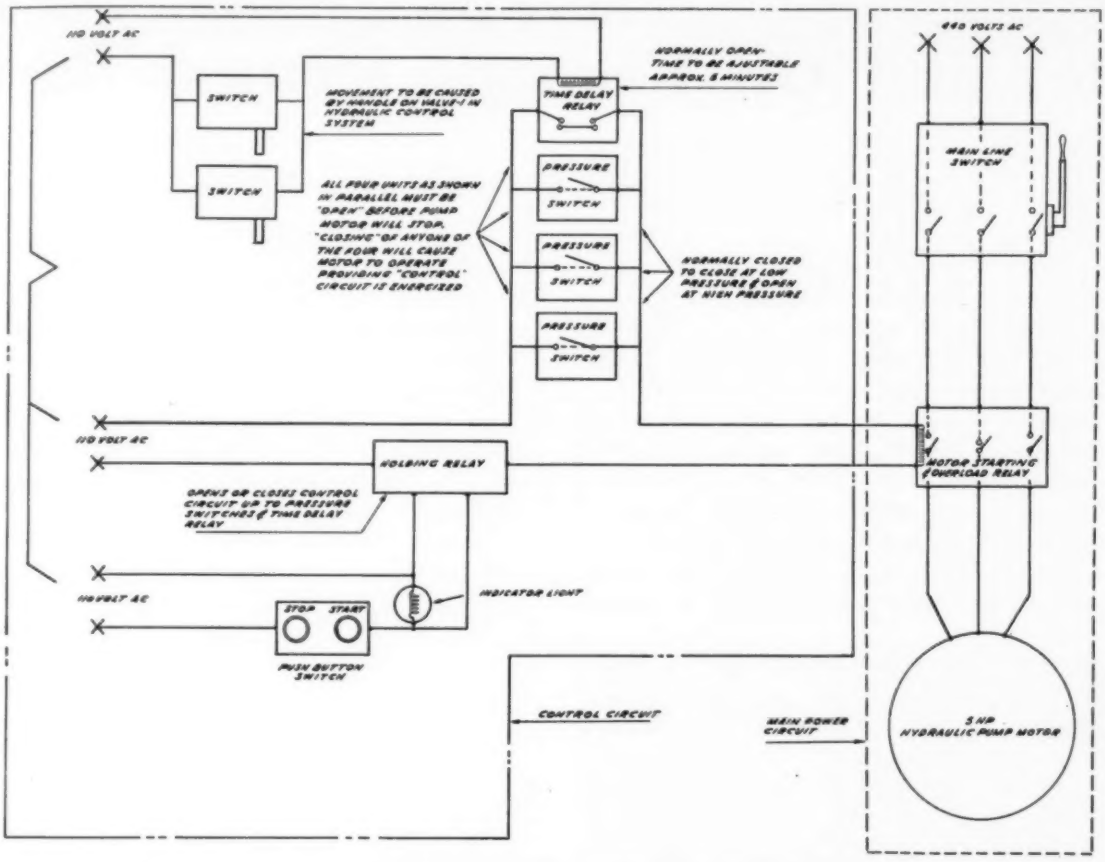
The drive motor and measuring instrument platform is mounted on accurate ways and is screw driven. The motivating force to the screw is supplied by a rotary, fixed displacement, fluid motor. Locking of this unit is accomplished in two ways. A single acting spring return clutch actuating cylinder which is an integral part of the fluid motor, automatically locks the motor shaft whenever pressure to the motor drops below a pre-determined point. The second locking medium consists of two pairs of cylinder actuated clamps which hold the drive platform tightly against the rails.

In addition to the foregoing, it is necessary to protect the operator and equipment through the use of electrical and hydraulic interlocks and safety stops. The use and placement of these protective devices is covered in the following circuit description.

## Oil Circuit Analysis

Valve 1 controls the upward movement of the single acting elevator ram. The top of the ram supports the pump holding platform. The valve is shown in the neutral position. With globe valve "A" tightly closed, globe valve "B" completely open, and by directing oil from port "P" to "A" a rapid lift of the ram takes place. When the desired height of the ram is nearly reached, the valve control handle is moved to direct oil from "P" to "B". The oil then flows through a flow control valve in line "B" which can be adjusted to obtain a very slow and accurate lift of the ram.

Spring loaded check valves are inserted in the "A" and "B" lines to prevent leakage from the ram during the time lapse which occurs between the return of valve 1 to neutral and the closing of brake band control valve 2. The ram can only be lowered when the brake band is released and globe valve "A" is opened.


110 VOLT AC
SWITCH
SWITCH
MOVEMENT TO BE CAUSED BY HANDLE ON VALVE-1 IN HYDRAULIC CONTROL SYSTEM
ALL FOUR UNITS AS SHOWN IN PARALLEL MUST BE "OPEN" BEFORE PUMP MOTOR WILL STOP. "CLOSING" OF ANYONE OF THE FOUR WILL CAUSE MOTOR TO OPERATE PROVIDING "CONTROL" CIRCUIT IS ENERGIZED
NORMALLY OPEN-TIME TO BE ADJUSTABLE APPROX. 5 MINUTES
TIME DELAY RELAY
PRESSURE SWITCH
PRESSURE SWITCH
PRESSURE SWITCH
NORMALLY CLOSED TO CLOSE AT LOW PRESSURE & OPEN AT HIGH PRESSURE
440 VOLTS AC
MAIN LINE SWITCH
110 VOLT AC
HOLDING RELAY
MOTOR STARTING & OVERLOAD RELAY
OPENS OR CLOSES CONTROL CIRCUIT OF TO PRESSURE SWITCHES & TIME DELAY RELAY
110 VOLT AC
INDICATOR LIGHT
STOP
START
PUSH BUTTON SWITCH
CONTROL CIRCUIT
MAIN POWER CIRCUIT
5 HP HYDRAULIC PUMP MOTOR

Electrical circuit for the pump test stand provides efficient operation of the hydraulic pump. Use of pressure switches provides for pump operation only when the system demands oil. It is only necessary for the operator to press one push button to energize the control circuit.

On exceptionally large pumps where extreme vibrations during test runs are expected, globe valve "B" is closed after positioning is complete. Closing of this globe valve merely serves to trap the oil in the ram and prevents possible settling due to heavy vibrations. Normal test operations do not include use of this valve.

Due to the construction of the brake band and upper portion of the ram, it is necessary to provide a safety interlock which prevents the ram from being raised at any time while the brake band is locked. If the ram was raised while it was locked, the band mounting arrangement would be damaged. To prevent this from occurring, a pilot operated check valve dumps the oil in the ram pressure line into the tank when the ram brake is closed. To prevent the ram from settling before the brake is completely locked, a time lapse is introduced by using a fine restriction in the check valve pilot line. The orifice diameter was determined by trial. With this arrangement, the brake band is completely locked before the ram pressure line is opened to the tank. Any consequent flow into the ram pressure line, due to misuse of the ram control valve, will be carried back to the tank unless the brake band is opened.

Valves 2 and 3, which are of the two-position type, control their respective locking cylinders. Again a sequence problem is encountered which is solved through use of pilot-operated check valves. It is necessary that the brake be locked before the elevator table locks are applied and that the table be unlocked before the brake is released. The pilot-operated check valves serve to trap the oil in the cylinders and prevent their movement if control valves 2 and 3 are not operated in proper sequence. Check valves are used to isolate these two locking circuits from the rest of the system. Both sections must maintain constant holding pressure throughout the entire test.

Since average component parts of a hydraulic system can be expected to present a leakage problem, it is necessary to have a pressure source constantly available to maintain holding pressure by replacing lost fluid. There are two possible solutions to this problem; one is to allow the main pump to run continuously and the other is to introduce an accumulator into each holding

*(Continued on page 52)*

# Water and Oil Reshape Dented Barrels

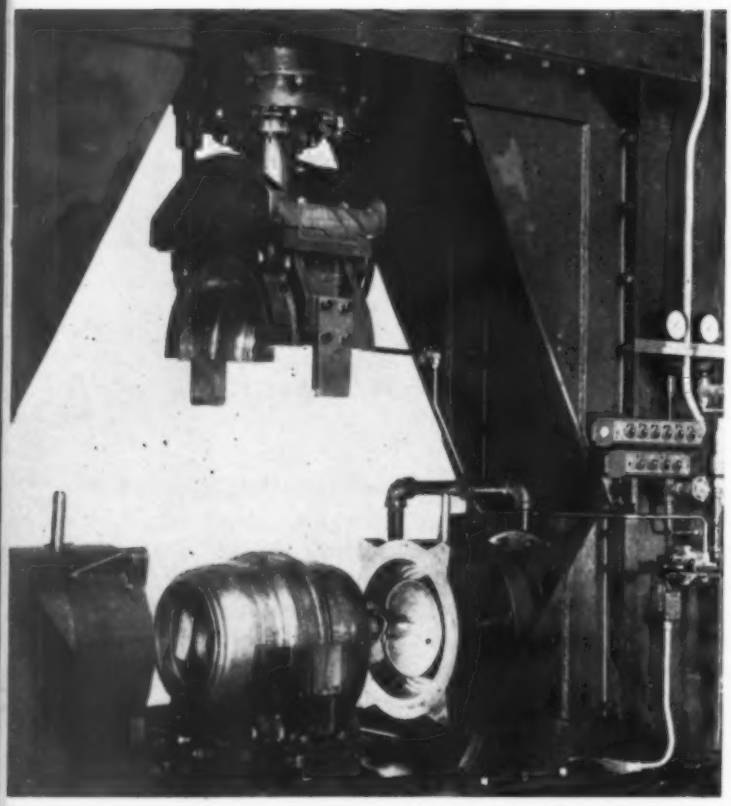
METAL BARRELS WHICH HAVE BEEN DENTED MAY be quickly and economically resized on this barrel dedenting machine, designed and built by the Kent-Ownes Machine Co., Toledo, Ohio.

The damaged barrel is completely enclosed with molds which are backed with sufficient oil pressure to withstand the internal water pressure. The water pressure causes the metal of the barrel to be driven out against the inside of the mold, thus resizing and removing the dents.

To attain the specified production it is preferable to prefill the barrel before placing it on the loading cradle. However, the barrel can be loaded empty directly on the loading cradle, and filled with water in that position.

Movement of the molds and other mechanisms is effected by hydraulically driven rams, electrically controlled from a push button panel, readily accessible to the operator.

The machine is so designed that various types of contour molds may be used, depending on the kind of barrel being serviced.



**THE BARREL IS PLACED** on the cradle and will be held and enclosed by the descending main ram and the two end rams. High pressure water, forced into the barrel, will reshape it to fit the surrounding mold.

## Circuit Data

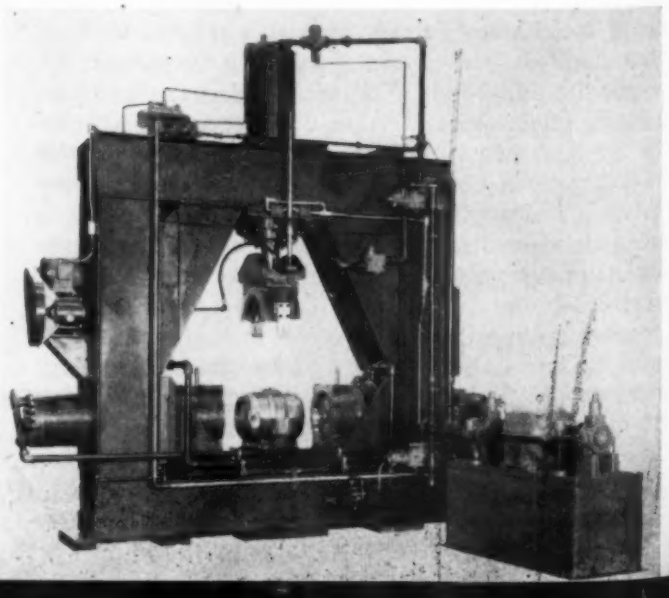
The barrel dedenting oil circuit uses a pressure booster which provides a system capable of developing 3000 psi, while using variable delivery pumps which have maximum pressure ratings of only 300 and 600 psi.

The booster provides high pressure to the mold rams during the dedenting operation when water pressure inside the barrel may reach 1800 psi. The booster will not operate until pressure on the main ram is great enough to open shut-off valve 8 and direct oil to the booster. The booster, capable of multiplying the input pressure 7 to 1, then supplies high pressure oil to the main and side rams. Flow to the side rams is controlled by shut-off valve 16.

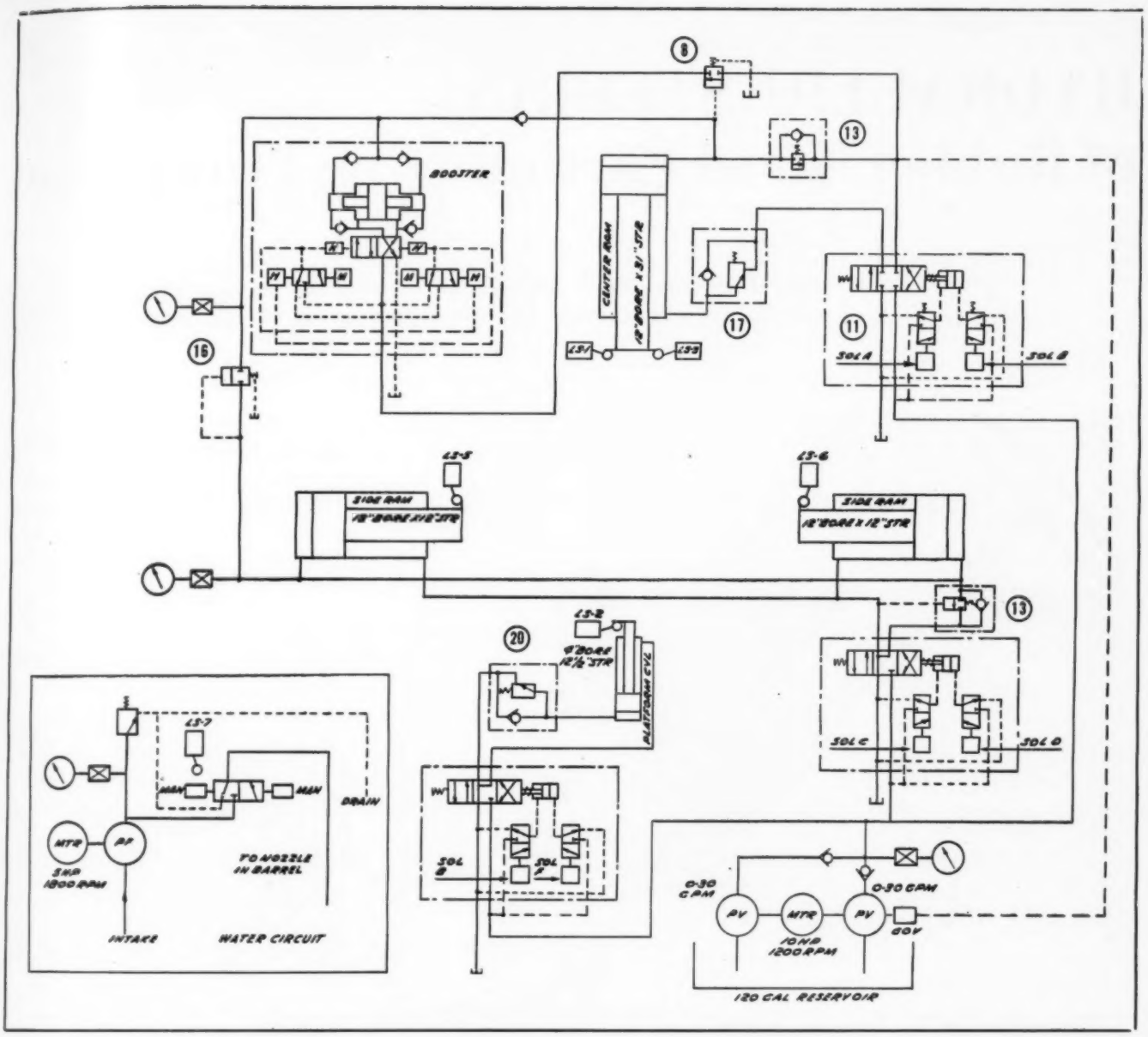
Resistance and check valves, 17 and 20, in the platform and main cylinder circuits, assure a positive back-pressure to cushion the downward travel of these cylinders.

Pilot operated check valves, 13, are used to block off high pressure from parts of the machine operating on low pressure.

Closed center porting on 4-way, pilot-operated,



**OIL PUMPS AND ELECTRIC** motor drive are mounted on the oil reservoir, located separately from the main machine frame. This rear view of the barrel dedenting machine shows the booster mounted on the top, to the left of the main ram. Note the mounting of the valves and limit switches which control movement of the molds.




solenoid-controlled valve 11, traps oil in the main cylinder to prevent it from falling by gravity when the valve is in neutral.

The delivery of the variable volume pumps is automatically reduced as pressure in the rams builds up.

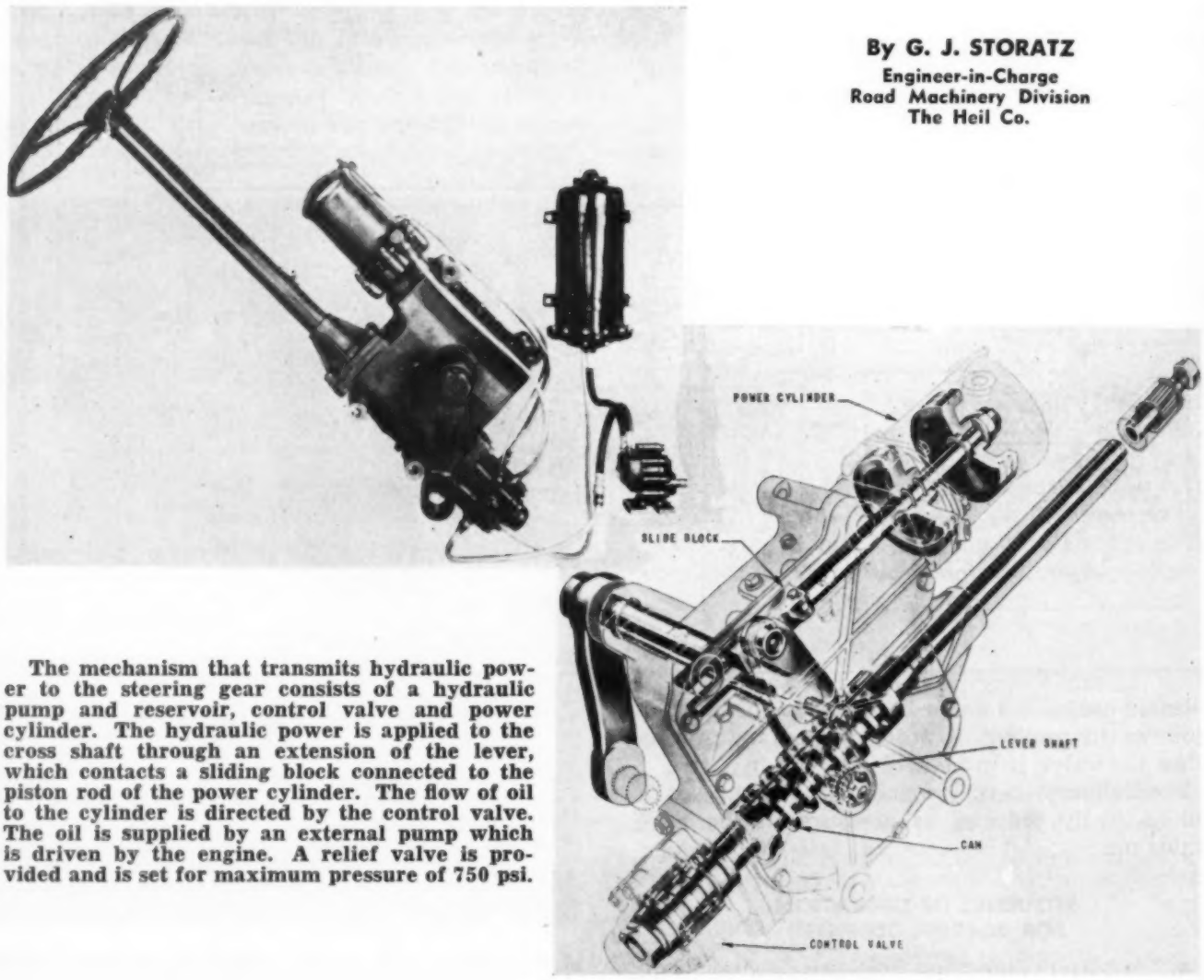
### SEQUENCE OF OPERATION FOR BARRREL DEDENTER

- The barrel is pre-filled with water and manually placed on the loading platform.
- Push button "center ram down" is pressed which energizes solenoid A, lowering the center ram. This push button can be released at any time to open the circuit and stop the downward movement. The bung hole may be manually aligned with the nozzle when it contacts the barrel. Holding in push button "center ram down" brings the ram down until the center band molds are closed, operating limit switches 1 and 3. The pressure of the ram on the barrel partially depresses the platform.
- LS 3 closes holding circuit to the relay energizing sol A, so that pressure is maintained on the center ram. High pressure is built up by the hydraulic booster.
- LS 1 completes the circuit to push button "platform down". Momentarily pressing this push button energizes sol B, lowering the platform to clear the path of the side rams, and to operate LS 2. The sump end mold is now aligned with the barrel by hand.
- LS 2 completes the circuit to push button "side rams in". Momentarily pressing this push button, energizes sol C, advancing the two side rams with the end sections of the mold until the mold is closed.
- Pressing push button "water pump start" builds up water pressure until the relief valve is opened. Shifting the lever on the water valve directs the water into the barrel, and opens LS 7 which prevents any of the rams from moving with water pressure in the barrel. When the relief valve opens again, the valve lever is shifted back to cut off water from the barrel. Push button "water pump stop" should now be pressed.
- LS 7 completes the circuit to push button "side rams out". Sol D is energized to retract the side rams until they operate LS 5 and LS 6. Both LS 5 and LS 6 must operate to complete the circuits to push buttons "center ram up" and "platform up". Sol E is energized to raise the center ram, and sol F is energized to raise the platform with the dedented barrel.

# HYDRAULIC STEERING of Rubber Tired Earthmoving Equipment

Part 1 presents three methods of mechanical steering with hydraulic assist to provide smooth and rapid maneuverability.

By G. J. STORATZ
Engineer-in-Charge
Road Machinery Division
The Heil Co.

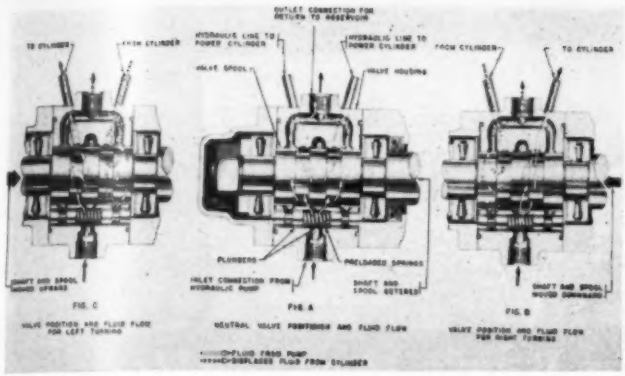



**The mechanism that transmits hydraulic power to the steering gear consists of a hydraulic pump and reservoir, control valve and power cylinder. The hydraulic power is applied to the cross shaft through an extension of the lever, which contacts a sliding block connected to the piston rod of the power cylinder. The flow of oil to the cylinder is directed by the control valve. The oil is supplied by an external pump which is driven by the engine. A relief valve is provided and is set for maximum pressure of 750 psi.**

**1.** A compact, completely housed, integral steering assembly which is installed with the same type of mounting used with conventional steering gears is used on the Euclid tractor. The mechanical linkage between the steering wheel and knuckles is similar to that used in a mechanical steering mechanism.

The action of this steering gear is both manual and hydraulic in effect. When the cam is turned to the left or right, by the driver's effort on the steering wheel, the stud of the lever is moved through the groove of the steering arm. However, the driver's effort at the steering wheel exceeds the preload of the control valve centering springs, the hydraulic system comes into operation automatically and relieves the driver of excessive loads.

In addition to acting as a booster, the hydraulic system resists kickbacks or shock, which might cause the driver to lose control of the vehicle.

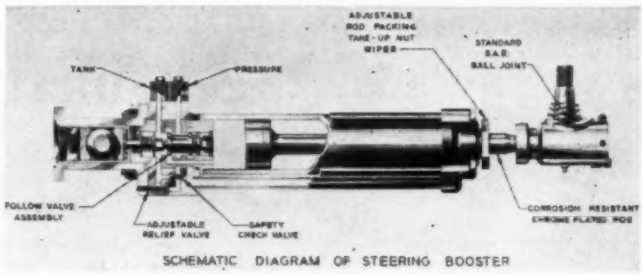


**The control valve spool moves axially with the cam. These two parts are restrained from axial movement by the pressure of the centering springs and the oil pressure against the centering plungers. Both effects tend to center the spool and hold the valve in the neutral position. Axial movement of the cam results in compressing the centering springs between one thrust washer and adapter in one direction and the other thrust washer and end cap in the opposite direction. Full pressure is obtained with only a few thousandths of an inch valve movement.**

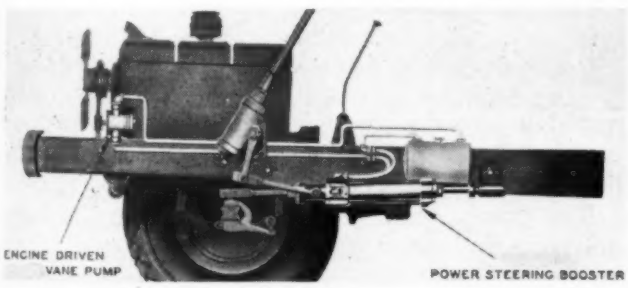
---

**2.** A second hydraulic assist system uses a conventional steering gear and a commercially available hydraulic steering booster. The steering booster is a fast-moving, double-acting, hydraulic cylinder with an integral control valve, relief valve and check valve. Oil under pressure turns the front wheels of the vehicle to any position the driver selects.

An engine driven vane type pump develops the necessary hydraulic pressure which is proportional to the steering thrust requirement. Normally the operating pressure is low, but the maximum continuous duty rating of 1000 psi allows a wide service safety factor.



SCHEMATIC DIAGRAM OF STEERING BOOSTER




The action of the booster's hydraulic mechanism responds automatically to any movement of the Pitman arm ball stud. Movement of the ball stud moves the control valve to the right, directing the oil pressure to rod end of the booster cylinder chamber, producing a linear movement of the cylinder and attached drag link to the right. Oil from head end of the booster cylinder is directed back to the tank. Booster control cylinder and valve body move to the right until control valve again reaches neutral position. Further movement of control valve by steering gear is necessary to produce additional drag link movement.

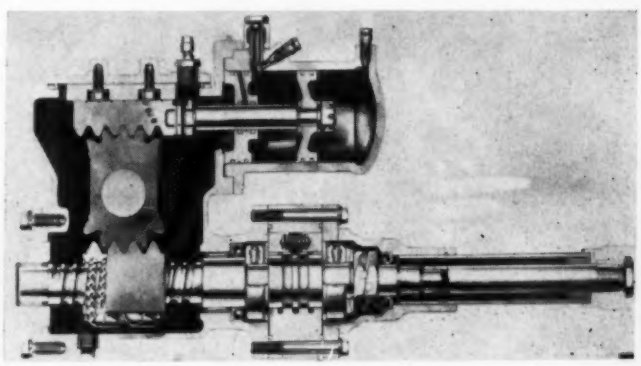
---

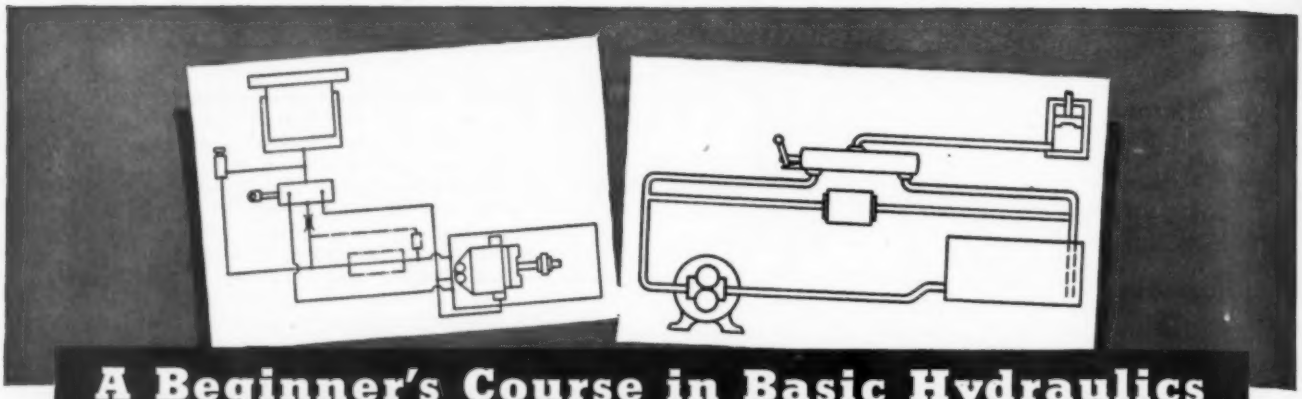
**3.** The present Caterpillar power steer incorporates a recirculating ball type of steering gear with the power cylinder and control valve as described in the Euclid steering mechanism.

In the event that the manual effort required to steer the vehicle becomes excessive, the hydraulic system comes into action automatically.

The cutaway picture shows the principal working parts of the gear, — the steering worm, the ball nut, the Pitman shaft and sector, the control valve and hydraulic cylinder. The worm is welded integrally to the steering main shaft and is supported on needle bearings in the housing. Between the needle bearings the worm is threaded with a precision finished helical groove. The ball nut is bored to clear the outside diameter of the worm and the bore is threaded with a precision finished helical groove corresponding to that in the worm. Within the length of the nut the helical grooves are filled with steel balls.

*(Concluded on page 74)*





# A Beginner's Course in Basic Hydraulics

**Chapter VIII**

## HYDRAULIC PUMPS

**Part 3**

**Internal Gear Types**

***Performance and application of three different constructions of internal type gear pumps.***

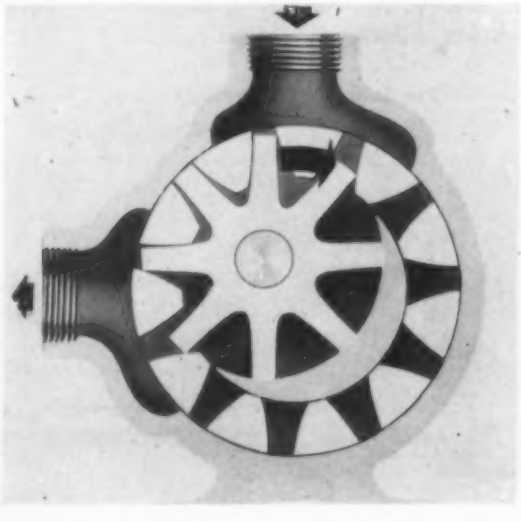
GEAR TYPE PUMPS MOVE OIL FROM SUCTION TO discharge by trapping the oil between the meshed teeth of the rotating gears. The capacity, or amount of oil delivered, is determined by the speed of rotation and the amount of space which the oil can fill between the teeth. For a constant speed, the pump is a constant volume source.

The ability of the gear pump to build up and maintain pressure as required by the given load is determined primarily by mechanical strength, fits, clearances and bearings.

The principle of gear pump operation and the delivery and pressure characteristics were discussed in Part 2 where external gear pumps were described. The basic ideas have been briefly repeated here to emphasize the similarity of action

Fig. 5. On the Viking internal gear pump, the outer gear is driven from the power source and rotates the idler pinion. The stationary crescent which is a projection of the pump end cap seals the discharge from the suction side. Oil drawn in the suction port, as the gears unmesh, is trapped within the gear teeth and forced out the discharge port by the meshing of the gears.

Fig. 6. The pump may readily be powered by an internal combustion engine for applications on road and agricultural equipment.



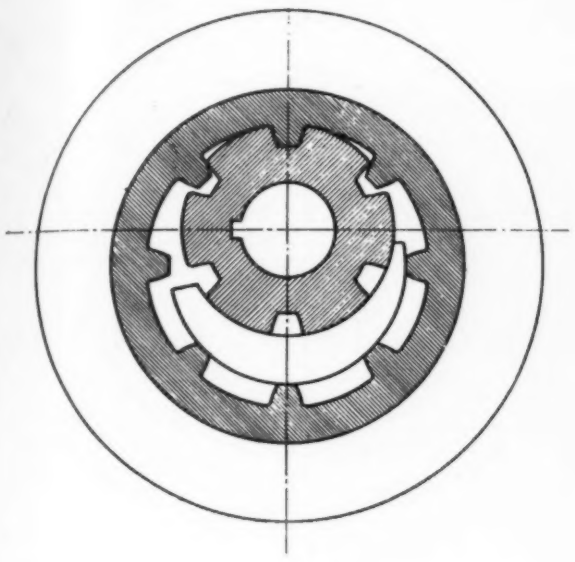
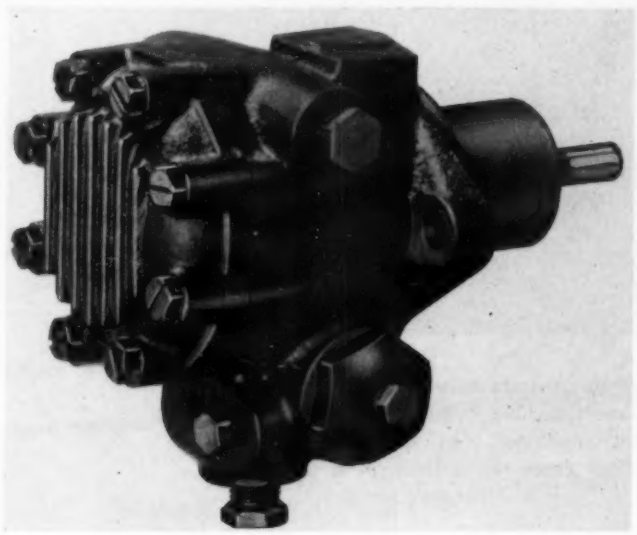


Fig. 7. The center roller of this Sundstrand pump drives the outer ring or rotor. The roller's shaft is mounted on ball bearings and on larger models the rotor revolves on roller bearings. This design pemits the construction of very small pumps. The unit pictured here has approximate maximum dimensions of 5x7 inches.



between external and internal gear pumps.

What is considered to be the conventional type internal gear pump is shown in Figure 5. The elements of this pump are the internal gear or rotor, the idler spur gear, the crescent seal and the housing.

Power applied to the rotor is transmitted to the idler gear with which it meshes. The idler gear is supported off center, and the space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the fixed crescent shape. This crescent, which is a projection in the inner face of the pump cover, acts as a division between the suction and the discharge.

As the teeth come out of mesh near the suction port, a partial vacuum is created and oil is forced into the space by atmospheric pressure. The liquid stays in the spaces between the teeth of the rotor and idler until the teeth mesh, near the discharge port, to force the oil out of the pump.

This style of internal gear pump is built in sizes providing capacities from 5 gpm to 200 gpm with maximum operating pressures of 500 psi.

Figure 6 shows a Viking internal gear pump powered by an internal combustion engine through a flexible coupling. The prominent curved tube on the pump is a suckback tube used between the seal chamber and suction port. This design feature serves to prevent leakage along the drive shaft. Any seepage is drawn back to the suction port before it can move down the shaft.

The driving power on the Viking pump is applied to the outer internal gear. Another construction, using the same elements, supplies power to the inner spur gear which then drives the outer gear.

The direction of pump rotation determines which port is the suction and which is discharge. If it is desired to keep the same suction and discharge ports for both directions of rotation, it is

*(Continued on page 55)*

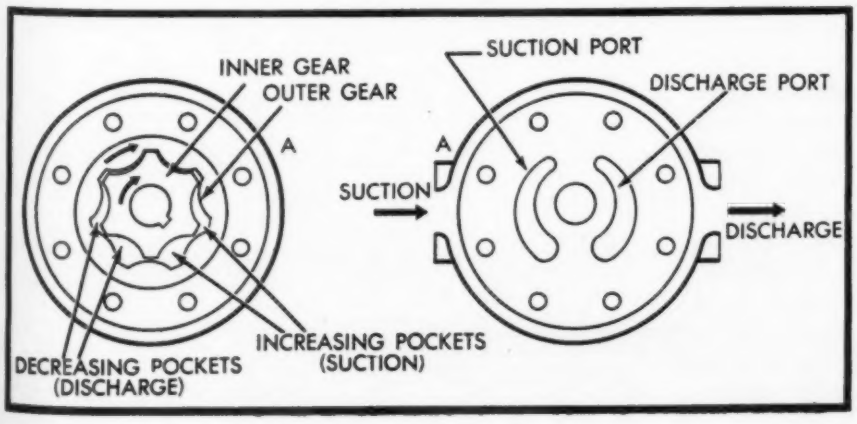



Fig. 8. The Gerotor pump design eliminates the need of a separating crescent by having a continuous sliding contact between each tooth on the pinion and outer gear.

**Chip guards have** been removed to show the air-hydraulic cylinder in the base of the cut-off machine. The special cylinder moves the tool cross slides through a rocker arm.

# Air Conversion For Automatic Cycling

EXCESSIVE LABOR COSTS ON SIMPLE STOCK CUT-off operations are often the result of using manually controlled machines. To make better use of valuable man-hours, the Modern Tool Company of Jackson, Michigan has designed and built a cut-off machine using air operated cylinders which smoothly and quickly feed stock, operate collets and move cut-off tools automatically and in the proper sequence.

## Operating Cycle

Stock feed rolls are rotated continuously by pulley and gear arrangement from the electric drive motor which also rotates the machine spindle. A stock feed cylinder closes the rolls on the stock for feeding and opens the rolls to stop the feed. The collet segments are actuated by the cylinder to open ¼ in over stock size to permit passage of stock with burrs.

As the tubing feeds through the spindle at about 140 fpm, it hits a trip plate at the stock stop, operating a limit switch. Location of this trip plate is readily adjustable to give required stock length. The limit switch energizes the solenoid valve, to close the collet and open the feed rolls. When the pressure in the collet control cylinder reaches 40 psi, the 4-way master control valve by-passes air into the air-hydraulic cylinder, controlling the two cross slides.

The cross slides, each carrying a tool holder, are mounted at 30 degree angles to the horizontal, one above and one below, and are operated from a large rocker arm by adjustable cams. This rocker arm is moved up and down by an air cylinder at a speed which is controlled by a hydraulic cylinder. In this arrangement, air is forced into the bottom of the lower cylinder and the top of the upper cylinder, forcing the hydraulic fluid through regulating and check valves to control movement of the cutting tools or cross

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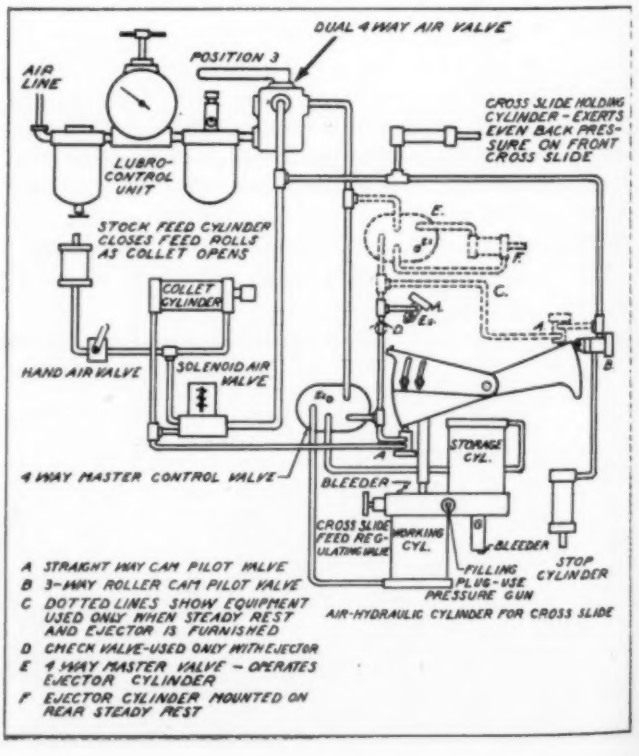
**Shop air supplies** the power to properly feed the stock, operate the collet and move the tools. The dotted lines show the added piping when steady rest and ejector are added.


DUAL 4 WAY AIR VALVE
POSITION 3
AIR LINE
LUBRO-CONTROL UNIT
CROSS SLIDE HOLDING CYLINDER - EXERTS EVEN BACK PRESSURE ON FRONT CROSS SLIDE
STOCK FEED CYLINDER CLOSES FEED ROLLS AS COLLET OPENS
COLLET CYLINDER
HAND AIR VALVE
SOLENOID AIR VALVE
4 WAY MASTER CONTROL VALVE
BLEEDER
STORAGE CYL.
CROSS SLIDE FEED REGULATING VALVE
WORKING CYL.
BLEEDER
FILLING PLUG-USE PRESSURE GUN
STOP CYLINDER
A STRAIGHT WAY CAM PILOT VALVE
B 3-WAY ROLLER CAM PILOT VALVE
C DOTTED LINES SHOW EQUIPMENT USED ONLY WHEN STEADY REST AND EJECTOR IS FURNISHED
D CHECK VALVE-USED ONLY WITH EJECTOR
E 4 WAY MASTER VALVE - OPERATES EJECTOR CYLINDER
F EJECTOR CYLINDER MOUNTED ON REAR STEADY REST
AIR-HYDRAULIC CYLINDER FOR CROSS SLIDE

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Even, full length loading of the bearings in these pumps is accomplished by use of a new principle—Positive Aligned Gears. "Positive Alignment" was developed and perfected by "Commercial" and permits high speed operation at pressures up to 1500 p.s.i.

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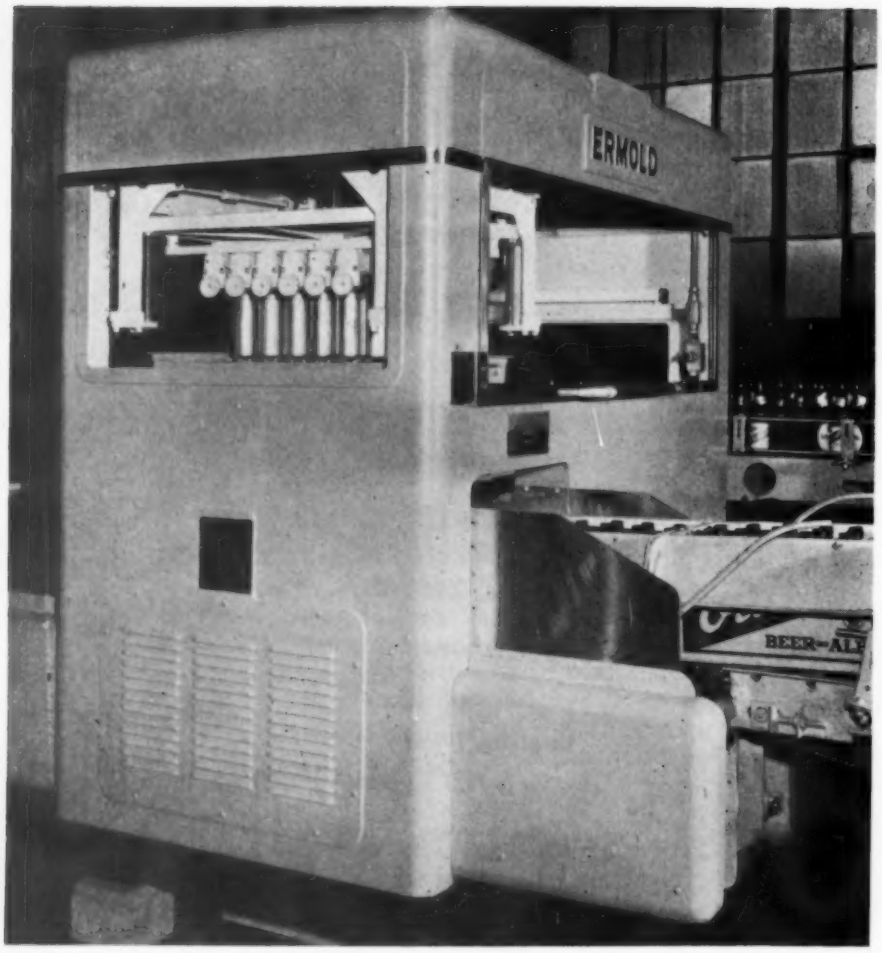



Fig. 1. The front or entering side of the automatic unpacker, showing loaded cases entering and empty cases leaving the machine. The gripper head is shown in position for gripping the necks of containers. The entire machine is enclosed, suitable access panels being provided for servicing and cleaning all parts of the machine.

# Automatic Case Unpacker Steps Up Production, Eliminates Breakage

A NEW AUTOMATIC CASE UNPACKER, HYDRAULically powered and electrically controlled, has been put into production by the Edward Ermold Company of New York. Experience with earlier pilot models and continued design studies have resulted in a simplified, streamlined design; the first installations of the production model have proven the basic soundness of the hydraulic application and given complete satisfaction in actual production.

This machine, while designed with the needs of breweries and of milk bottling plants in mind, is equally advantageous and economical in any industry where glass or porcelain containers are used. The machine is equally applicable for new as well as reusable containers, wide mouth as well as narrow neck containers and for a range of sizes from dainty cosmetic or perfume jars or bottles to demijohns. Since the whole operation is automatic and the machine speed is adjustable to the most efficient rate of handling any given size or shape container, definitely higher production handling rates are assured. Another important advantage is that container breakage is greatly reduced. For example as a result of the installation in a brewery bottle house, the soaker breakage was reduced from an average of 3-½ per cent to less than one tenth of one per cent.

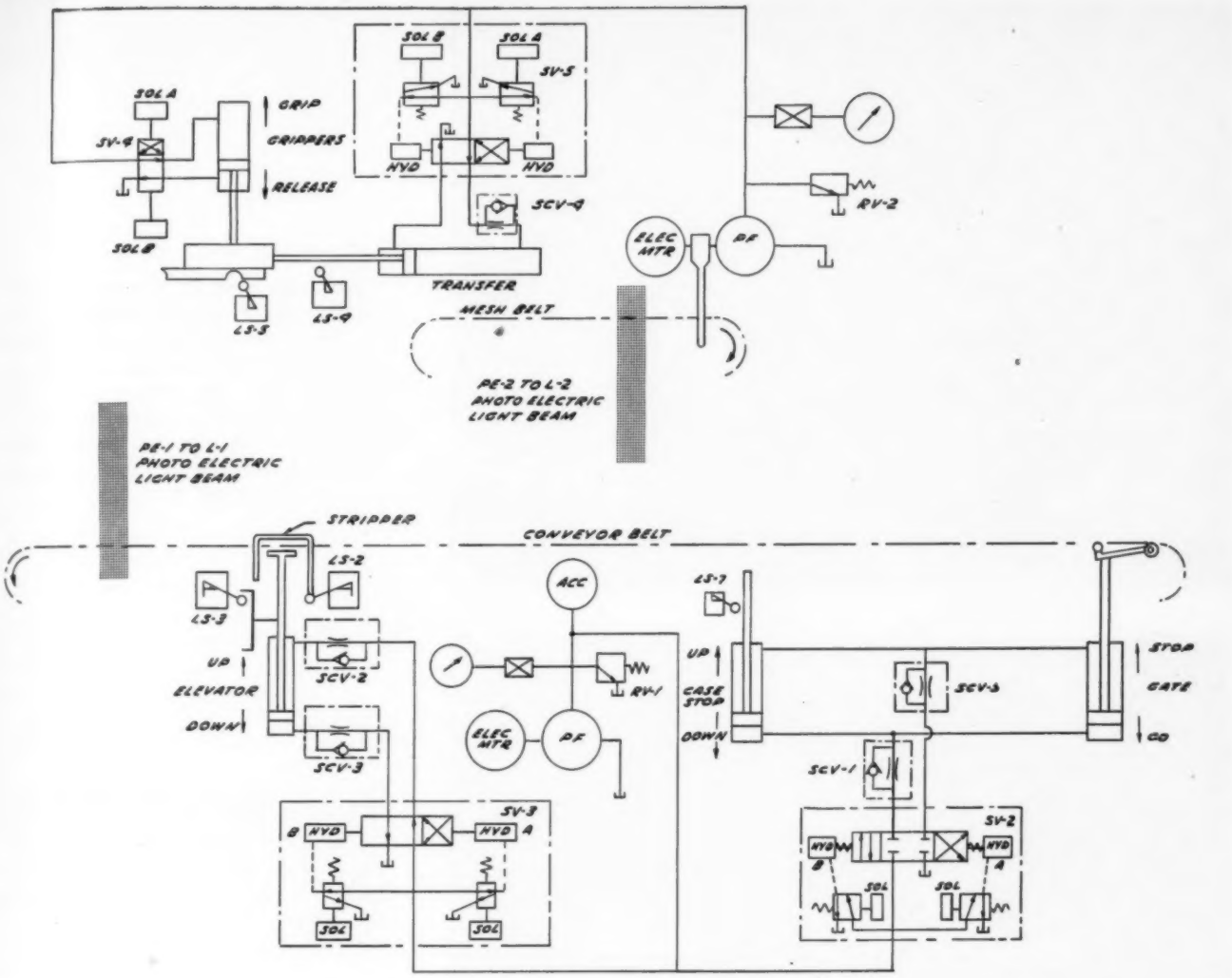



Fig. 2. The two hydraulics circuits with limit switches and photoelectric circuits.

The Ermold Company is one of the pioneer and leading manufacturers of bottle handling equipment, including labeling machines. Over a period of years these machines were entirely mechanical in operation. As is often the case, the accretion of parts was such that the units, while adequate for their purpose, represented a hodge-podge of mechanical slides, cams, gears, racks and pinions and nearly every other common mechanical movement. When the new automatic unpacking machine was under initial discussion, it was determined, designwise, to make a fresh start and to keep the new unpacker as simple and as "clean" as possible.

Designs made and analyzed indicated that hydraulic operation and electric control would give the most efficient power utilization with the fewest possible number of parts and components and promised a reliability in operation and ease of servicing and maintenance that was considered very desirable. The overall cost—always a major factor—also promised to be in line.

The eventual design incorporated three power circuits for operation, two of which were hydraulic. Since the sequence of operation was critical, the electrical control circuits, essentially limit switches, photoelectric circuits and solenoid operation of valves, was carefully designed, tested and reduced to essential components.

Figure 1 shows the front or entering side of the unpacker, with loaded cartons entering and empty cartons leaving the case conveyor. This operation is entirely mechanical. The gripper assembly is shown in the process of gripping the containers, while in the background bottles, having been moved off the mesh belt, are shown moving to the soaker.

Two hydraulic circuits, each to be described in more detail later, do all of the operation, aside from moving the case conveyor and bottle conveyor.

The first hydraulic circuit operates one cylinder to open and close the entrance gate, a second cylinder to raise and lower the case stop and a

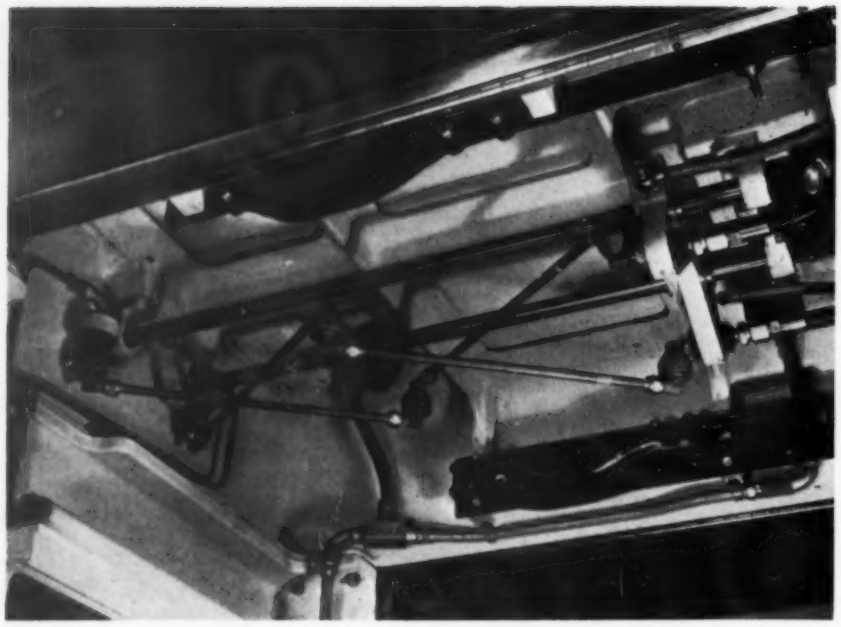


Fig. 3. A view of the top transfer cylinder area of the unpacker. An aviation type swivel joint assembly is shown extended (cylinder piston retracted). As the piston advances (moves left), it moves the gripper carriage from the elevator to the mesh discharge belt. The unloading dip in the carriage track is shown.

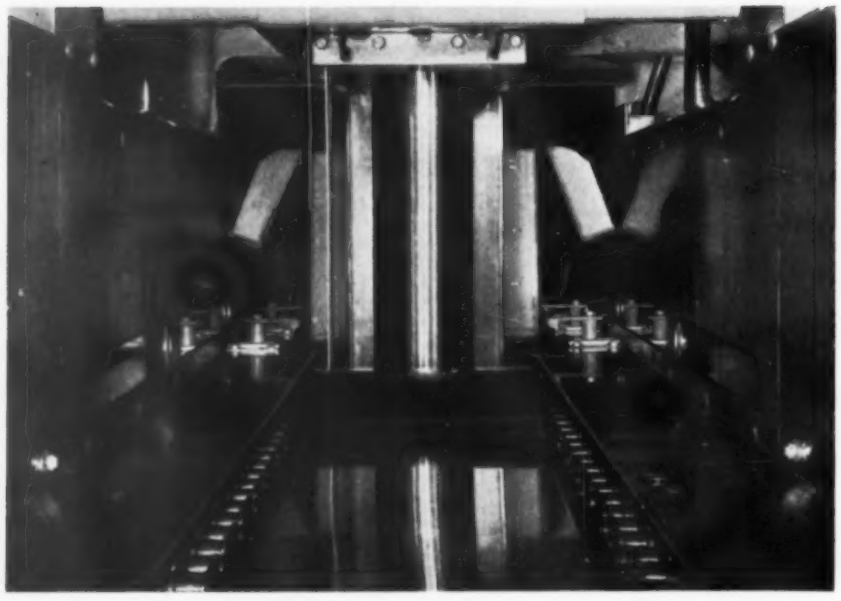


Fig. 5. A view into the case elevator through the side of the machine with the elevator raised. The photoelectric beam slots are shown. The entering gate is in the up position, witholding the carton shown at the far end of the conveyor.

third cylinder which functions as the elevator.

The second hydraulic circuit operates the top horizontal transfer cylinder which powers the gripper assembly carriage travel from the elevator (retracted) to the unloading position and return, and a second cylinder which grips and releases the grip fingers. The mesh belt is driven off the motor pump shaft.

## Summary of Operation

By pressing either one of the conveniently located starter buttons, the three motors are started. A one hp motor drives the adjustable volume vane type pump in the first hydraulic circuit. The three cylinders for operating the entering gate, case stop and elevator are powered by this pump. In the second hydraulic circuit a two hp motor drives a second adjustable volume vane type pump which powers the transfer cylinder and the gripper fingers. The mesh belt is driven off the two hp motor shaft through a vertical shaft speed reducer and bevel gear box. The third motor, a gear head type with twin horizontal shaft extension, drives the case conveyor.

The control circuits are arranged so that the case entering gate is closed until the elevator is in the down position and the emptied case or carton has been conveyed toward the case discharge end of the machine until the trailing edge of the case leaves the light beam and the photoelectric circuit of PE-1 to L-1 is restored. This permits the entering gate to open and the case stop to raise. Simultaneously, the transfer cylinder has retracted, carrying the gripper assembly back above the elevator area.

The case, admitted by the gate, is conveyed

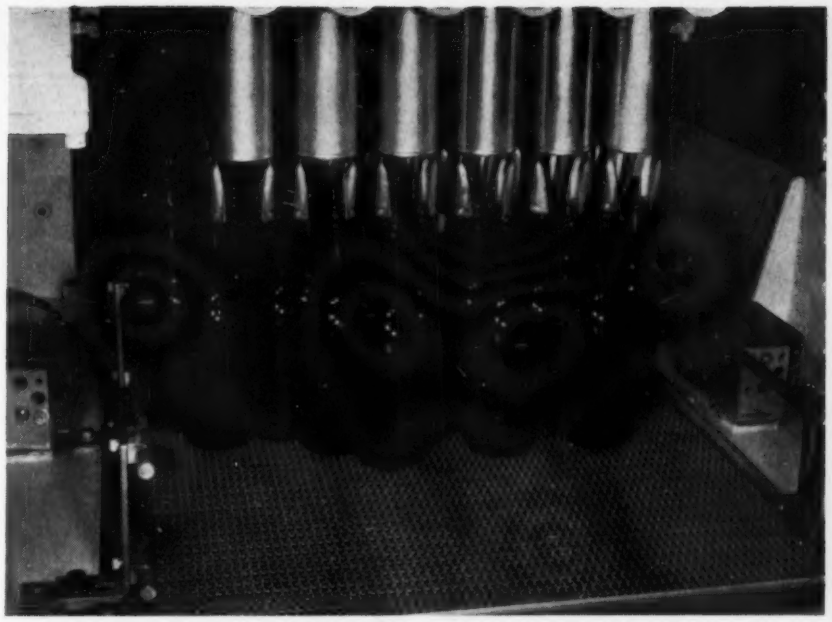


Fig. 4. The unloading operation is shown. The gripper carriage has reached the track dip, the containers have been deposited on the mesh belt and the gripper fingers have just been released. When the belt has moved the containers clear of the photoelectric beam path, the machine is ready for another cycle.

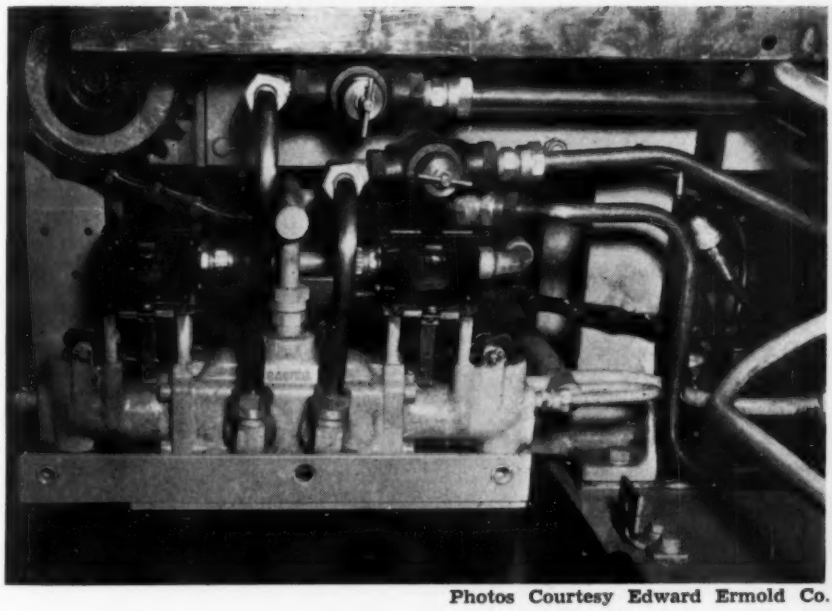


Fig. 6. The solenoid operated elevator control valve with two speed control valves, part of the first hydraulic circuit in which three hydraulic cylinders operate the elevator, the case stop and the entrance gate. The sprocket drives the case conveyor.

Photos Courtesy Edward Ermold Co.

into the machine by the continuously operating case conveyor. The leading edge of the case interrupts the photoelectric circuit of PE-1 and L-1, causing the gate and stop to be raised. When the gate stop is fully raised, fluid under pressure is admitted into the elevator cylinder, causing the elevator, case and stripper to be raised vertically.

When the elevator reaches its top position, grip fingers in the gripper assembly close on the neck of each container and after a short delay (grip time .2 sec.) the elevator, emptied case and stripper are lowered. The case is redeposited on the case conveyor and moved toward the case discharge end of the machine.

Immediately after the elevator has been lowered, the transfer cylinder carrying the gripper assembly begins to extend, moving the assembly away from the elevator and toward the mesh belt. The gripper assembly moves on an overhead track (Figure 3) at the outer end of which is a dip. When the gripper assembly holding the containers reaches the dip, the bottoms of the containers are lowered into contact with the mesh belt, which has been pre-set to travel at the same speed. The articles are released onto the mesh belt and conveyed from the machine. The gripper carriage is returned over the elevator and a new, full case is conveyed into the machine for a repetition of the cycle.

## Hydraulic Circuit

A one hp electric motor drives the adjustable volume vane pump. Operating pressure is adjusted by means of a pressure relief valve off which is a dial gauge. The one gallon hydro-

*(Continued on page 50)*

FRED O. HOSTERMAN
Advisory Editor

# Inverted Relief Valves in Aircraft

**Characteristics and applications of the inverted relief valve compared with conventional type.**

By HOWARD F. SCHMIDT

ACTUAL EXPERIENCE WITH THE INVERTED RELIEF valve in aircraft has proved that this design fully satisfies the requirements of a good relief valve, and in addition has inherent features which make it an extremely flexible basic arrangement.

Any discussion of relief valves should first define the purpose for which they are used and establish the requirements of good performance. Most frequent use of the relief valve is as an overload limiting device in hydraulic pressure circuits, to protect components and structural

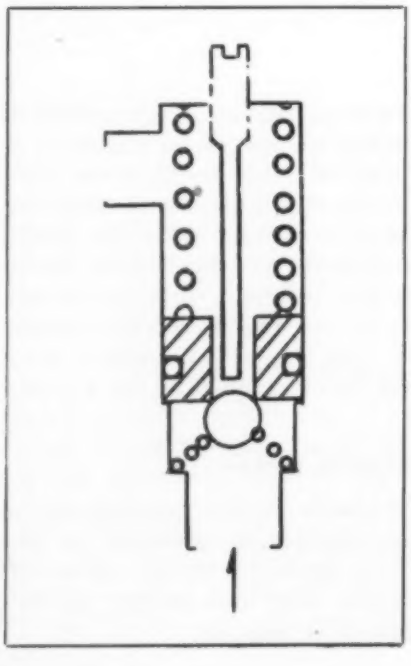


Fig. 1. Seat pressure in the conventional relief valve, left, is proportional to the difference between fluid pressure and spring force.

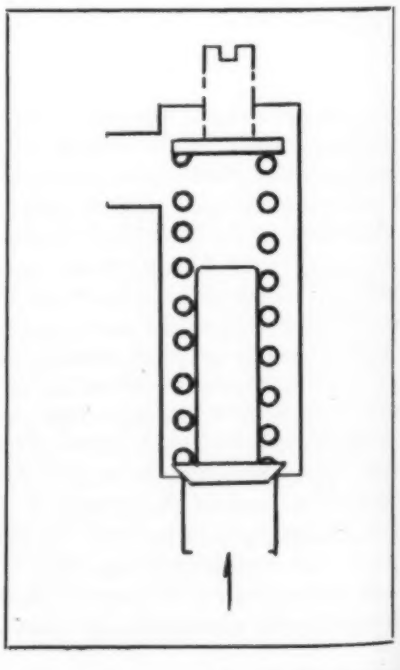


Fig. 2. In the inverted relief valve, right, seat pressure is directly proportional to the fluid pressure up to the point at which the abutment contacts the ball to open the valve.

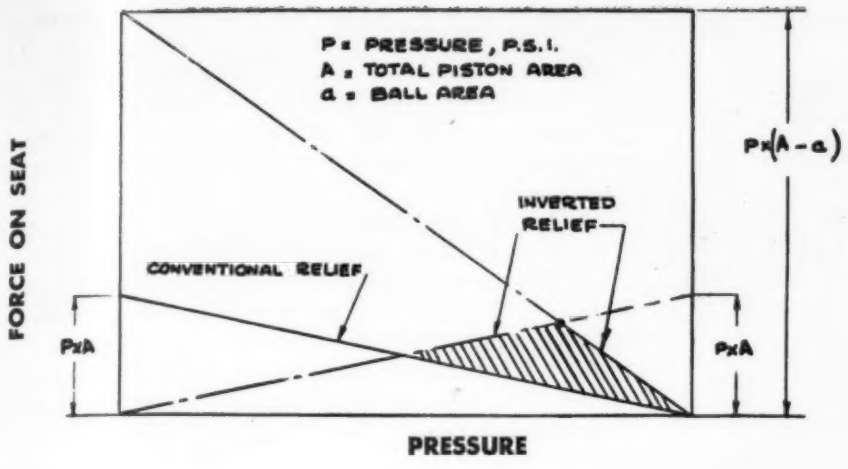



Fig. 3. Seating force on the conventional valve is zero at the point of opening. On the inverted relief valve, seating force increases with pressure and is a maximum at the point of unseating. The shaded area represents the range of advantage of the inverted design over the conventional relief valve.

fluid transmission tubes from damage due to malfunction of normal regulating devices. For such applications relief valves are set to relieve at some value of pressure slightly above the normal operating pressure of the system, without creating an excessive pressure rise within the protected circuit.

Another major use of relief valves is for flow limiting applications and for pressure sequencing. In sequencing arrangements, the relief valve is inserted into a system to prevent a function occurring down stream of it until a previous function has been performed upstream.

Still another service is performed by relief valves to provide protection to closed or locked circuits from excessive pressure due to the expansion of the trapped fluid resulting from temperature variations. These are known as thermal reliefs.

Since the measure of any hydraulic system's efficiency is the ratio of work output to work input, it is obvious that losses of fluid or pressure due to internal leakages of valves throughout the circuit will result in a waste of power. A good relief valve, therefore, should have a minimum of leakage up to the point at which it is set to relieve.

Basically an emergency device to relieve overloads, the good relief valve must be ready to open instantly when it is called upon to act. Once open, it must pass a maximum of flow with a minimum of pressure drop or must have good regulating characteristics. The valve must reseat to a minimum leakage at a pressure, and throughout its entire cycle be dynamically stable and free from chatter. The energy released during chatter is frequently great enough to cause serious seat damage.

To appreciate fully the function of a relief valve, it should be realized that the pressure energy of the fluid is dissipated by converting it into heat, the fluid being forced to accelerate to a high speed. This velocity is high, and hence, the actual amount of valve lift is small.

A typical conventional relief valve is shown in Figure 1, and in Figure 2 the inverted relief.

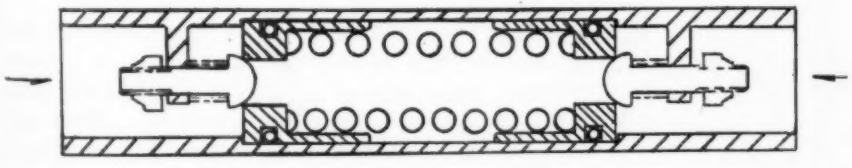
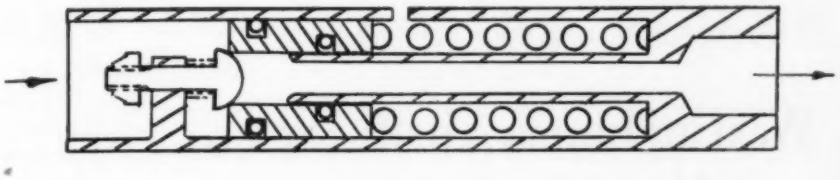


Fig. 4. The twin inverted valve design, shown above, permits unsymmetrical relief settings while using a single spring.

The inverted relief valve permits free reverse flow. Many applications, particularly in the aircraft field, find this an extremely desirable feature.

Fig. 5. A balanced outlet or cheater valve, seen below, will relieve at its preset pressure regardless of back pressure. Unseating the inverted valve in Figure 2 could be prevented by a high back pressure, whereas high back pressure on the cheater valve assists unseating.



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It can be readily seen that the seat pressure of the conventional relief is proportional to the difference between fluid pressure and spring force, whereas on the inverted relief the seat pressure is directly proportional to the fluid pressure up to the point at which the valve is unseated.

Figure 3 illustrates that at the point of opening, the conventional valve has zero seating force as fluid pressure is in equilibrium with spring force, while with the inverted relief, the seat force increases with pressure and is maximum at the point of unseating or opening. This arrangement gives the inverted arrangement superior seating characteristics.

### Minimizes Valve Chatter

In the conventional relief, the poppet or ball remains seated and static until cracking pressure is reached. With the inverted relief, the poppet or ball and piston move freely together, the motion starting at some pressure below the actual cracking pressure. This arrangement assures the moving mass of the valve being in motion and ready to crack instantly the ball or poppet is unseated.

When the conventional relief is just opening, the pressure drop is not instantaneous, but is a gradient across the seat width. Since the seat has width, when the valve lifts, the pressure acts for a moment on a larger area. This causes dynamic instability or chatter.

After opening of the inverted relief, pressure transfers from the combined ball and piston area to the piston area minus the ball area and the pressure increases until the seat moves away from the ball. This portion of the valve's function is similar to a conventional valve except that the slope of the seat force curve is extremely steep and equivalent to a conventional valve having a very high initial spring tension.

Since the inverted relief requires of necessity a piston seal or packing, this provides inherent heavy damping.

Another inherent feature of the inverted relief valve is that of free reverse flow. Many applications, particularly in the aircraft field find this an extremely desirable feature. However, when not required, the non-reverse flow arrangement can be readily provided.

Due to the unique feature of free reverse flow, a dual arrangement of relief is feasible with extreme simplicity; Figure 4. This arrangement, it will be noted, provides use of a single spring, while permitting unsymmetrical relief settings.

A more recent outgrowth of the inverted relief design has been the balanced outlet relief. In this unit the effect of downstream pressure is entirely eliminated, providing a valve which will relieve at its pre-set pressure regardless what back pressure is used.

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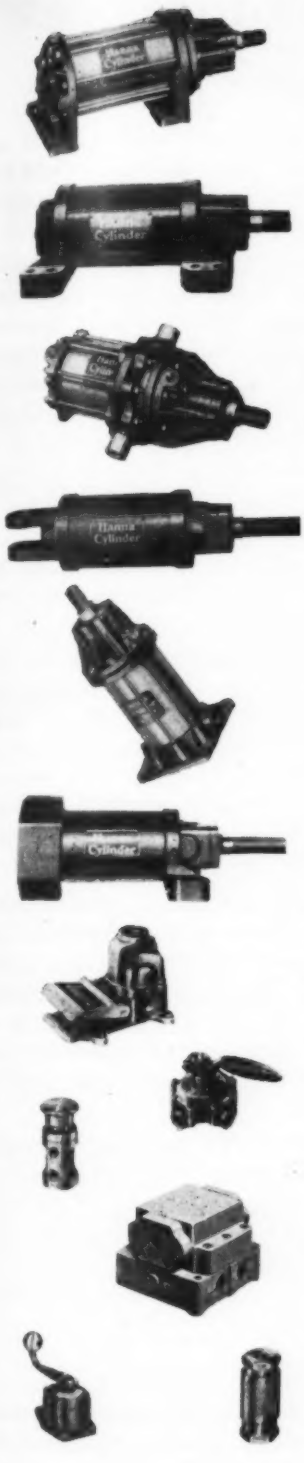

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HYDRAULIC AND PNEUMATIC EQUIPMENT
CYLINDERS . . . VALVES . . . RIVETERS

# AN Component Approval Procedure

A MANUFACTURE OR SUPPLIER OF A VALVE, PUMP or other component or unit for hydraulic or pneumatic circuits who wishes to secure AN (MIL) approval, must first determine if a current AN Specification covers the component or unit he wishes to have approved. This can be conveniently determined from the latest Index of Specifications issued by AMC (address Commanding General, Air Material Command, Wright-Patterson Air Force Base, Dayton, Ohio) or by BuAer (address Bureau of Aeronautics, Navy Department, Washington, D. C.).

*Prepared by APPLIED HYDRAULICS in response to readers' requests, this procedure has been reviewed and approved by the using Military Services.*

The manufacturer or supplier then should request copies of the AN Specifications concerned. Such specifications can be procured from AMC through Department MCREXU61 (all such requests should be addressed to the attention of this department). Each AN Specification gives all the qualification tests required and pertinent data on procedure after a component has passed initial specific qualification tests.

The manufacturer can run the qualification tests or he can have them made by a qualified test laboratory. When the designated series of qualification tests have been successfully passed, the manufacturer or supplier may then write to AMC or BuAer (whichever is testing such units) and request permission to send such units, with complete data, as prescribed.

AMC or BuAer, when they have approved such requests, will undertake to schedule such units for testing in one of their laboratories. AN approval is given only after one of the Services has completed the prescribed series of qualification tests.

The Service will then report completed series of qualification tests to the Aeronautical Standards Group, who, in turn, will formally approve the original application. AN standard components, when approved, will be listed in the applicable ANA approved Source Bulletin or newer Qualified Products List (QPL). The latter is used with all new Military specifications and the QPL number is the same as the final numerical number of the applicable Military spec number.

The using Services will then accept such approved manufacturers or suppliers as approved sources for specific items thus qualified.

There are some exceptions for conditional acceptance by AMC and BuAer. Either may accept a component or unit for use on the basis of qualification tests made by the manufacturer, supplier or qualified test laboratory. Such conditional approval or acceptance is usually granted on non-standard equipment for a specific airplane. Military tests alone qualify for AN approval.

There are certain AN standard components, such as tube fittings, which are completely detailed on the drawing and do not require qualification tests, provided certain specified metals and workmanship is used. Such fittings must be stamped with the applicable AN part number (drawing, not spec) and the manufacturer's name or trade mark.

The entire procedure of AN approval normally takes a number of months and some classes of products or materials may take a year or more because of priorities and the heavy schedules now confronting the Service laboratories.

## Inverted Relief Valves

*(Concluded from page 46)*

This arrangement finds wide usage in the aircraft field as a fluid priority or schedule valve, to assure a supply of fluid and pressure to certain vital circuits, regardless of other demands on the system. Sometimes referred to as a "cheater", the valve is inserted in the power supply line beyond that portion of the system requiring fluid priority, and ahead or upstream of the lesser priority circuits. Thus, on high performance aircraft having control surface power boost, and a common hydraulic system for boost and utilities both, when the landing gear is extended on landing approach there is a momentary loss of power due to the cavitation of the gear cylinders as gravity assists the gears down. It is desirable to "cheat" the utilities circuits and extend priority to the vital boost system, so that consistant surface control power is always available.

Insertion of a balanced outlet relief in the circuit functions to supply all pressure and flow to the boost circuit at a minimum pressure established by the boost power requirements, and to permit only that fluid not demanded by the boost circuit to serve the balance of the utilities in the system.

Similar protection is frequently required for braking circuits which may momentarily lose power due to flap operation or bomb door operation during taxi.

# Tests Show

## HOW AUTOMATIC SEALING WORKS IN *Vee-Flex*® *Packing Rings*

**Simplified Diagrams of Stress Trajectories**

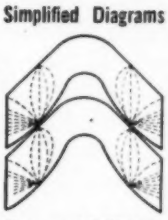


Diagram of R/M Vee-Flex Rings with convexly curved surfaces

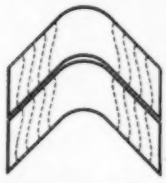


Diagram of ordinary "V" type rings with flat contact surfaces

R/M Vee-Flex Rings for hydraulic equipment are self-sealing and self-adjusting. They are designed so that hydraulic or gas pressure automatically expands the lip or circumference of the ring on the pressure stroke, forming a tight seal against stuffing-box wall and shaft. On the return stroke, the ring resumes normal position, thus reducing wear. Recently, Raybestos-Manhattan sponsored a series of photoelastic stress analyses* and radial pressure tests* on packing ring designs. From the test data, the Research Department of Raybestos-Manhattan has made the following conclusions:

**1.** Because the Vee-Flex Rings have a convexly curved surface where they contact adjacent rings, a flexing action results which automatically produces a seal. Fringes in the photoelastic stress patterns showed that the R/M Vee-Flex design distributes pressure horizontally against the stuffing-box wall and shaft, as well as vertically against the next ring.

**2.** Ordinary "V" type rings with flat surfaces provide little or no automatic sealing action against the walls of the cylinder. Under extreme pressure, these rings are compressed, and the material is forced out (squashed) against the wall or rod. Photoelastic patterns showed no fringes.

**3.** There is relatively little stress in the apex of the "V" type ring. The apex of the Vee-Flex Ring is therefore purposely designed thin to increase sensitivity, especially on the low pressure return stroke.

**4.** Photoelastic analyses were corroborated by radial pressure tests in which maximum sealing performance occurred at a point slightly below mid-width on the sealing area. This was predicted by the photoelastic stress patterns as shown.

**Reliability**

R/M Vee-Flex Rings provide an effective seal at all pressures. They require only "finger-tight" gland adjustment and provide a perfect seal, even when pumps or hydraulic cylinders are not in motion.

Vee-Flex Rings nest together in sets, and the design brings full automatic expanding action to each of the nested rings. By increasing gland pressure, R/M Vee-Flex Rings continue to provide a reliable seal, even after wear has eliminated the automatic feature.

Vee-Flex Rings fit practically all hydraulic and fluid-handling equipment. They are used on hydraulic valves, pumps, cylinders, rams, lifts, presses, airplane shock absorbers, and similar equipment.

Six types provide sealing against all pressures used in modern hydraulic equipment, and are also suitable for service in contact with air, water, steam, petroleum products, other commercial fluids, and food products.

**FREE BULLETIN**

*This new bulletin gives detailed information on photoelastic stress analyses and radial pressure tests made on R/M Vee-Flex Packing Rings.*

**Performed at the Franklin Institute Laboratories for Research and Development.*

# PACKINGS

## RAYBESTOS-MANHATTAN, INC.

### PACKING DIVISION, MANHEIM, PA.

**FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.**

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings · Asbestos Textiles
Mechanical Rubber Products · Abrasive and Diamond Wheels · Rubber Covered Equipment
Brake Linings · Brake Blocks · Clutch Facings · Fan Belts · Radiator Hose · Powdered Metal Products · Bowling Balls



Circle 39 on Reader Service Card

# Directory Errata

IN BUILDING A MONUMENTAL WORK LIKE THE January issue of APPLIED HYDRAULICS there were bound to be errors, regardless of how careful we tried to be. Inasmuch as this is the first compilation of this type ever made we feel that the errors were surprisingly few; we were sorry there had to be any. Below are corrections of all errors that have been brought to our attention. We have waited until this issue to run such corrections so that any errors could have been called to our attention by this time.

**Baldwin-Duckworth Division of Chain Belt Company,** Springfield, Mass., suggests a further breakdown of the heading "Flexible Couplings", ie, "tension linkage applications" which would more exactly describe roller chain, leaf chain and turnbuckle assemblies. We're glad to have this information for next year.

**Berry Motors, Inc.,** Corinth, Miss., calls to our attention that the type of pump they manufacture should be designated a "rotary piston" pump.

**Blackhawk Manufacturing Company,** Milwaukee, Wisc., should have been listed under "Package Power Units" and "Pumps, Piston" and that listings under "Pump, Vane" and "Pumps, Vacuum" were in error. Also, to be strictly correct, the "Valve, Hydraulic" listing "G" (sequence, foot types) should rather have been "J" (unloading, pressure regulating unloading, bypass types).

The manufacturer's listing of **Greene, Tweed & Co.,** North Wales, Pa., "Flange" and "V" packings were omitted; that while the "V" packings was properly listed in the products listings, "Flange" and "U" packings were not listed. The correct listing in both sections is: Packings and Seals, Braided, Cup, Flange, Gasket, "V" and "U".

In the manufacturers listing for **International Packings Corporation,** Bristol, N. H., "Cup" and "Flange" types should be included to agree with the cross reference to their affiliate Graton and Knight Co., Worcester, Mass. Please add both names to "Packings, Cup" and "Packings, Flange" and the name of **Graton and Knight Co.** to "Packings, Gaskets", "Packings 'O' Rings", "Packings 'U' " and "Packings 'V' ", to agree with the same listings given International Packings Corporation.

The listings of "Chucks, Air Operated" for **Ross Operating Valve Co.,** Detroit, Mich. in both manufacturer and product sections is not correct and should not have been included in this listing as they do not manufacture such an item.

The correct address of **Superdraulic Corporation** (manufacturer section and product listings under "Pump, Piston" and "Transmissions, Hydraulic") is 14256 Wyoming Ave., Detroit 4, Mich.

**Weinman Pump & Supply Co.,** Pittsburgh, Pa. design and build package power units and should have been listed under that heading in the products directory.

---

## Automatic Case Unpacker

*(Continued from page 43)*

pneumatic accumulator assures adequate power for the elevator cylinder, during maximum load demand on the circuit. The circuit is shown in Figure 2.

The entering gate remains closed until the elevator and stripper are in the down position, both photoelectric circuits PE-1 and PE-2 are closed, the time delay relays are de-energized, the holding relay is energized, LS-4 and LS-5 are de-energized. When the above conditions are in effect, the four way solenoid valve SV-2B is energized, causing fluid under pressure to operate the gate and stop cylinders. This permits the entering gate to open and the case stop to be lowered.

The case, admitted by the gate, is conveyed into the machine by the continuously operating case conveyor. This conveyor operates at approximately twice the speed of the case feed conveyor, thus creating a gap between the incoming case and the succeeding cases. The case is conveyed into the machine until the leading edge of the case interrupts the light beam of PE-1 to L-1, energizing SV-2A, de-energizing SV-2B and reversing the operation of the gate and stop cylinders.

Near the end of the up gate stop cylinder stroke, LS-7 is actuated, energizing SV-3A, causing the elevator and the case, which by this time has reached the case stop—to rise vertically. LS-7 also energizes the jam release time delay relay. If for any reason a case becomes jammed during the elevator rise period, this relay is de-energized after an interval of three seconds, the elevator cylinder is reversed, the case is conveyed out of the machine and a new cycle is initiated.

When LS-7 is actuated as previously described, the four-way solenoid valve SV-3A will not be energized unless the gripper carriage is in posi-

tion above the elevator. This is indicated by LS-5 which must be closed.

Shortly after the elevator has started the up stroke, the case contacts the stripper, thus raising it to the top of the elevator stroke. A dog, fixed to the elevator, trips LS-3, thereby energizing the grip time delay relay and the four way solenoid valve, SV-4A. Fluid under pressure enters the gripper cylinder, closing the grip fingers and the entire complement of containers is gripped simultaneously in a single operation. After .2 sec., the grip relay times out, the holding relay is de-energized, SV-3B is energized and the elevator, emptied case and stripper start down. Near the end of the down stroke, the stripper contacts LS-2, energizing SV-5A and SV-2B. SV-5A directs fluid under pressure to the transfer cylinder, and the gripper carriage plus the full complement of containers is moved forward and away from the elevator area. SV-2B causes the gate and stop to go down, permitting the emptied case to be conveyed out of the machine and a new, full case to enter.

### Deposits Bottles on Conveyor

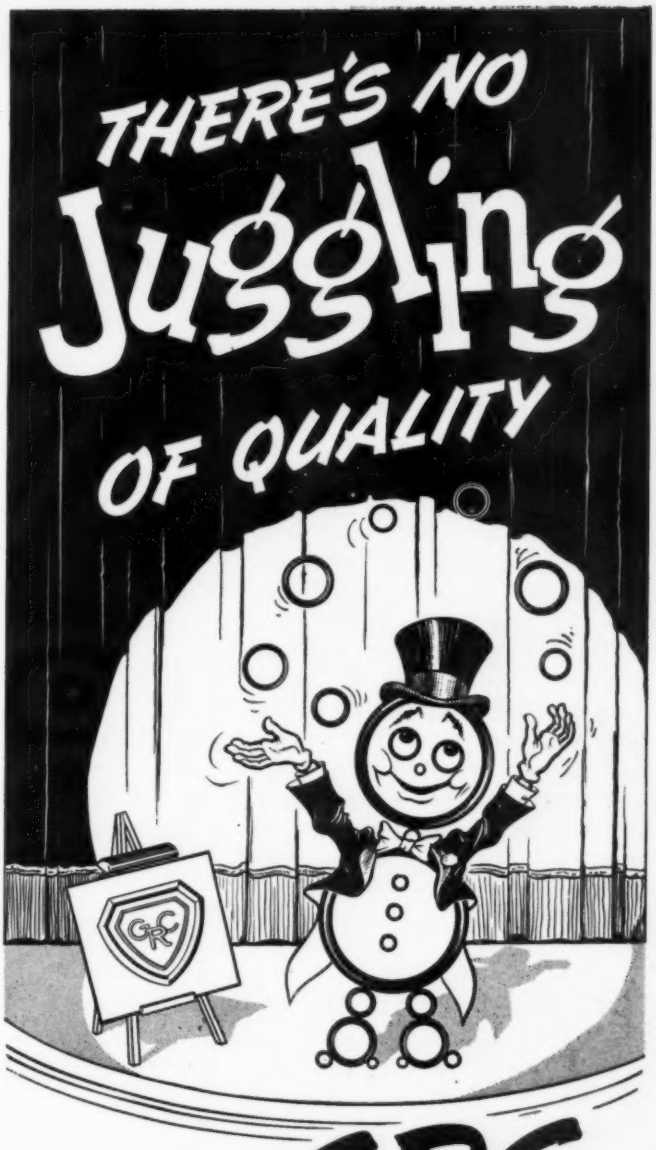
During the forward travel of the transfer cylinder LS-5 is contacted and the electric circuit is interrupted. At the end of the transfer cylinder travel, the cylinder actuates LS-4, opening the grippers. The articles are deposited on the mesh belt and conveyed away from the machine to the soaker or filling machine. Figure 4 shows the unloading operation. As long as the articles interrupt the light beam of PE-2 to L-2, the transfer cylinder is held inoperative.

When the light beam is restored, SV-5B is energized and the transfer cylinder is retracted and the gripper carriage is brought back above the elevator. During the return stroke, LS-4 and LS-5 are closed.

The new, full case in the meantime, has reached the case stop. The case stop actuates LS-7, permitting the elevator to rise and the cycle is automatically repeated.

Variations in operating speed of the machine are pre-adjusted to the containers handled by means of speed control valves—one on the case stop, two on the elevator, one on the gate and one on the transfer cylinder. The speed can be adjusted for operation of from 4 to 15 cycles per minute.

Several of the early applications of the Ermold unpacker have been in bottling houses of breweries where the machine is used to do the work normally done by three men. However, the machine does not replace trained workers. It does a job that is widely considered the most disagreeable and for which it is most difficult to secure operators. From the point of view of the workers, the most disagreeable job has simply been eliminated and since the unpacker is so simple to operate, anyone and everyone can and does operate the machine.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## Oil Operated Pump Test Stands

*(Continued from page 31)*

circuit. Of the two, the latter was deemed the most desirable because its use would greatly prolong the life of the pump.

To allow the accumulators to charge rapidly but discharge slowly, combination check and flow control valves are used as shown. This arrangement prevents a shock surge of oil from entering the individual circuits whenever the control valve positions are changed and still furnishes the pressure source required to replace lost fluid. A pressure switch is inserted in each of the holding circuits. Their function is to turn on the main pump when accumulator or delivery line pressures, beyond the segregating check valves, drop to predetermined levels. Thus, movement of the control handles causes a pressure drop in the delivery lines and automatically turns on the main pump to furnish hydraulic pressure to lock or unlock units as desired. When leakage in the system drains the accumulators to a certain level, the main pump will again be turned on to recharge the accumulator bottles. This arrangement provides an automatic supply of fluid whenever required by the circuit and maintains constant locking pressures without the operator's attention.

### Locking Motor Platform

Two-position control valve 4 controls the motor traverse locking cylinders. The circuit construction is the same as those using valves 2 and 3 except that fluid motor control valve 8 is supplied with hydraulic pressure only when the traverse lock cylinders are opened. With this arrangement, the motor platform can only be moved when it is unlocked.

### Control of Fluid Motor

Cam-operated valve 9 also prevents oil from reaching the fluid motor control valve if the platform movement exceeds certain limits of travel. Cams located on the motor platform operate this valve.

The fluid motor that rotates the screw which moves the motor platform can be rotated in either direction by moving the control handle of valve 8. This valve does not have conventional round ports but instead has diamond shaped openings along the control shuttle. This feature enables

*(Continued on page 54)*

Perkins Hydraulic Power Unit
Application – Proved
Perkins Hydraulic Power Unit combines high efficiency and quiet operation . . . completely enclosed for maximum safety . . . The Perkins Unit is proving high worth in a wide range of applications. Made by manufacturers of long and broad experience in the design and manufacture of quality industrial machinery.
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# FULL VOLUME HIGH PRESSURE

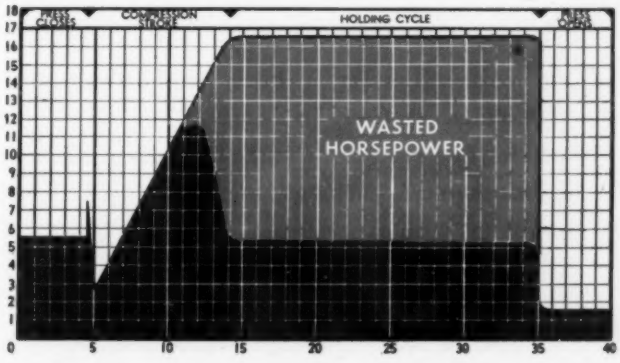
## . . . BUT LOW HORSEPOWER

## with RACINE *Hydraulic* PUMPS

High pressure holding is economical with RACINE Variable Volume Pumps. They will automatically cease their pumping action but maintain full pressure in the system. Instant change from no volume to full volume insures smooth, sure application of hydraulic force. Horsepower requirements are measured by the actual needs of the job — all of the oil is put to work.

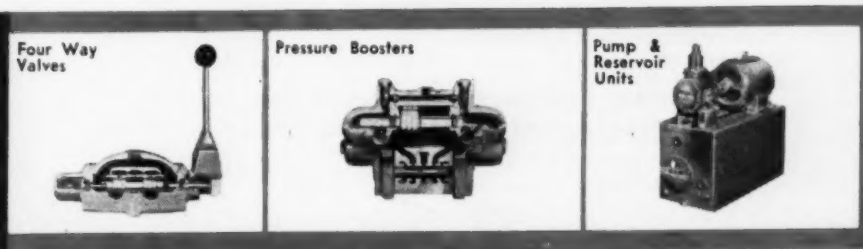
RACINE Variable Volume Pumps eliminate the need for relief valves — reduce oil heating — save horsepower and lower the over-all cost of most circuits.

Various standard governors are available for RACINE Pumps. These governors develop the pumping action that will best handle special requirements of the circuit. Maximum efficiency is assured.




*The graph to the right illustrates the horsepower savings in a simple press circuit using a* RACINE *Variable Volume Pump and Pressure Booster. The area in red represents the bypassed oil from a constant volume pump — lost power that is saved with* RACINE *Equipment.*

**OTHER RACINE HYDRAULIC PRODUCTS**




Write for complete catalog and engineering data.

**RACINE TOOL & MACHINE COMPANY**

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**UNSOLVED:** The amazing co-ordination of the fly-

Swat! Missed him, eh? That's because the fly moves so fast and its co-ordination is so nearly perfect. Using known materials, how would you build a machine to duplicate the fly's movements?

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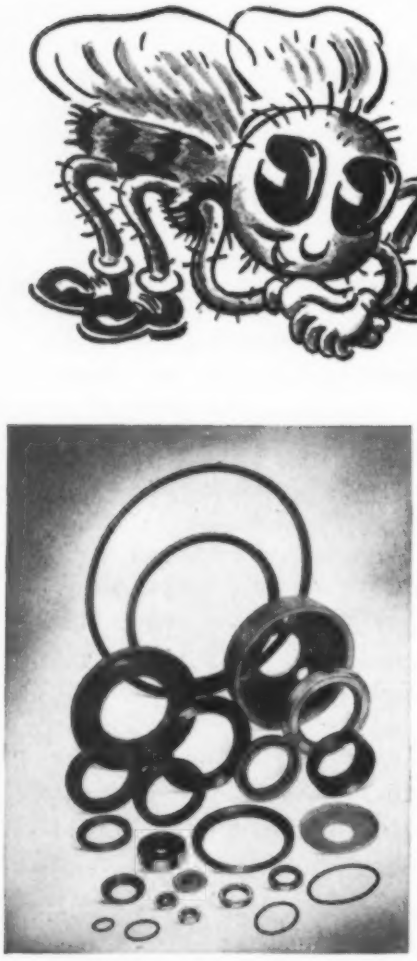

Again, co-ordination is the answer — the co-ordination of minds and skills. At G&K-INTERNATIONAL, our laboratory, engineering and production staffs have pioneered many developments in mechanical packings, and today are tackling the toughest problems with *experience.*

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*GRAKONE (synthetic) AND LEATHER* **PACKINGS**

IPC

100 YEARS OF SERVICE TO INDUSTRY

GRATON AND KNIGHT


*(Continued from page 52)*

the operator to inch the motor platform at any desired rate from full open to very slow speeds. Inching operations are greatlly simplified through use of these special ports. An auxiliary two-way valve is also a part of valve 8 which is shown in the neutral or hold position.

### Built-in Clutch

The clutch cylinder, which is an integral part of the fluid motor, is actuated by the same oil pressure that caused the motor to rotate. When valve 8 is moved to the neutral or hold position, the auxiliary two-way valve opens the clutch cylinder circuit to the tank. This drains the clutch cylinder, allows the spring to return the piston, and lock the fluid motor in position. The auxiliary two-way valve is only open when valve 8 is in the neutral or hold position.

As a further protection, each clamping mechanism has attached to it a micro switch which causes a red jewel to be illuminated whenever each respective lock mechanism is in an unlocked position. These red jewel lights are located on the same control panel that houses all control valves and are above each respective lever.

### Use of Pressure Switches

Movement of control valves 2, 3, 4 and 8 automatically starts the main supply pump because of the pressure switches in the circuit previously described. Control valve 1 does not have a pressure switch in its circuit because holding pressures are not required in the ram raising operation. It is necessary, however, that actuation of any control valve starts the main supply pump to supply oil pressure. To accomplish this, micro switches are operated by valve 1 which cause a time delay relay to close the main pump drive motor circuit and keep

the motor running for approximately three minutes. This is sufficient time to perform any particular positioning or locking operation and eliminates continual starting and stopping of the pump motor.

An additional protective device consists of another micro switch which is adjusted to the pump platform final setting prior to the test run. Any settling of the ram in the event of line rupture or equipment breakage will automatically stop the driving motor before misalignment damage can occur between the driving motor and the pump being tested.

The entire control circuit is energized by a push button. From that time on, all hydraulic pump starting, traveling and clamping is operated by movement of the control valve levers.

---

## Beginner's Course

*(Continued from page 37)*

possible on some pumps to rotate the position of the crescent 180 degrees.

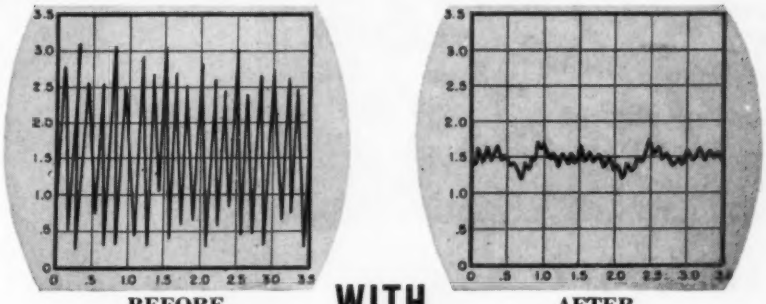
Where a small, compact pump is desired, internal gear design is particularly advantageous. The Sundstrand "Rota Roll" is built in small capacity models having an approximate outer diameter of only 5 inches. Larger models use the same construction as shown in Figure 7.

The "Rota Roll" consists of a pinion gear called the roller, driving an internal gear or rotor. The principle of operation is similar to the internal pump already described.

### Gerotor Principle

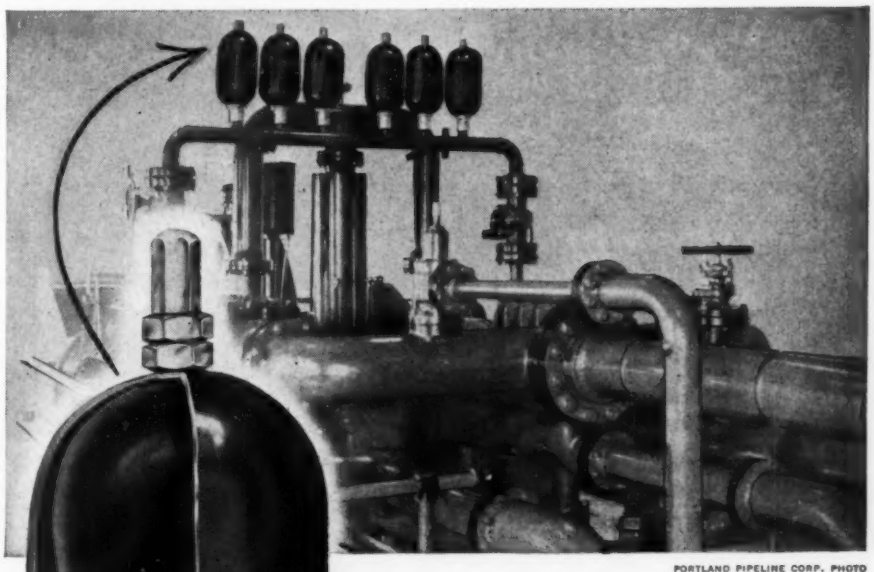
The third design of an internal gear pump, as manufactured by the Gerotor May Corporation, has two rotors, the pinion or inner rotor having one tooth less than the ring gear or outer rotor. The inner rotor is directly connected to


# PUMP PULSATIONS REDUCED 50 to 90%




BEFORE **WITH** AFTER

# GREER ACCUMULATORS



PORTLAND PIPELINE CORP. PHOTO

U. S. PATENTS UNDER OLEAR LICENSES

**Actual Hydrauliscope tests** on many kinds of machinery using reciprocating pumps proved that pressure surges can be reduced as much as 90%. From the Hydrauliscope drawings above, you see why engineers at *Portland Pipeline Corp.* no longer worry about this problem. Since installing Greer Accumulators on their equipment, pump pulsations were reduced 67% to give the smooth, steady flow so vitally important to longer life and better performance.

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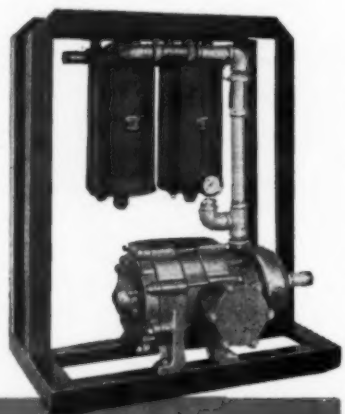
For pumping from a central supply tank or for cleaning vats and tanks the model AF-2000A combines a pump and double filter. Capacity up to 45 gpm depending upon pressure and viscosity. Available with either explosion or drip-proof motors.



**GENERAL FILTERS, INC.**

12890 WESTWOOD • DETROIT 23, MICH.


the power source and acts to drive the outer rotor. This design eliminates the crescent. To provide fluidtight engagement each tooth of the pinion is in continuous sliding contact with a tooth on the ring gear.

Figure 8 illustrates the Gerotor principle and shows the porting arrangement. At one side of the point of mesh, pockets of increasing size are formed as the gears rotate, while on the other side the pockets decrease in size. The pockets of increasing size are suction pockets, while those of decreasing size are discharge pockets.

**Submit Your Ideas**

**Tell us "Here's How" you do it at your plant. Sketch or jot down your labor-saver and send it in to the Editor—It may be worth $10.00 Every item published is worth $5.00, the best-of-the-month $10.00.**

In this design both gears rotate in the same direction, also the two gears travel slowly with respect to each other. The contact points revolve only once relative to each other for every seven revolutions of the drive shaft.

Maximum pressure recommended for these pumps is 1000 psi. Available models offer capacities from 1/3 to 30 gpm.

Particular care to eliminate dirt in the oil must be taken when using internal gear pumps. Efficiency of pump operation is quickly reduced when mating parts become worn suitable filters must be provided where service conditions are dirty.

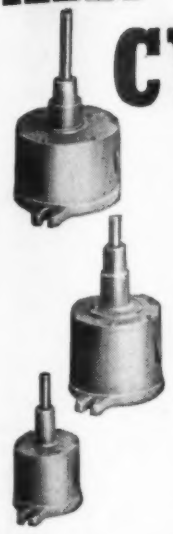
Internal gear pumps are built to handle 0 to 1000 psi pressure ranges, and capacities of 0 to 200 gpm at low to medium operating speeds with mechanical efficiencies up to approximately 70 per cent.

*Chapter VIII, Part 4 will discuss screw and lobe pumps. Please save each installment for future reference.*

Circle 45 on Reader Service Card

*Quicker Lockups with*

**SINGLE-ACTING AIR CYLINDERS**



| Bore | Strokes | |
|---|---|---|
| | Horizontal | Vertical |
| 1" | 5/8" | 5/8" |
| 2¼" | 1" 2" 3" | 1" 2" |
| 3" | | ½" 2" |
| 4" | 2" 2½" | 2" |
| 5" | 3" | 3" |
| 6" | 3" | 2" |

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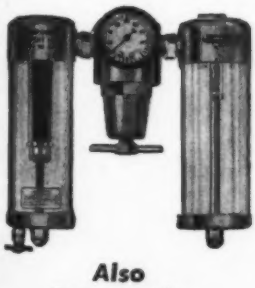
*Air Line* **FILTER, REGULATOR and LUBRICATOR ASSEMBLY**

**"Sentinel of the Airline"**



***Also Pneumatic Grinders***
"Remember, Built-in quality remains long after first-cost disappears"

**FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bar aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.**

Write for Literature

**M-B PRODUCTS**
46 Victor Ave.
DETROIT 3, MICHIGAN

**"SEALOL"**
PATENTED
*The Versatile Seal*

This balanced-pressure face seal really gets around — and it's easy to see why!

For a wide variety of rotary shaft applications — fluids, temperatures, speeds, pressures, and space requirements — there's a "Sealol" design. Here are a few examples:

**"SEALOL"– Sealed Fuel Pumps**

| | | | | |
|---|---|---|---|---|
| 36,000 RPM | ¾" Shaft | 200°F | Kerosene | 300 PSI |
| 3,500 RPM | ¾" Shaft | 150°F | Aviation Gasoline | 60 PSI |

**"SEALOL"– Sealed Hydraulic Pumps & Motors**

| | | | | |
|---|---|---|---|---|
| 1,800 RPM | 1⅛" Shaft | Room Temp. | Ucon Hydraulic Fluid | 1500 PSI |
| 11,000 RPM | 2¼" Shaft | 200°F | Lube Oil | 20 PSI |

**"SEALOL"– Sealed Transfer Pumps**

| | | | | |
|---|---|---|---|---|
| 1,750 RPM | 2½" Shaft | 200°F | Acid and Caustic Dye Liquors | 15 PSI |
| 3,500 RPM | 1⅛" Shaft | Room Temp. | Propane | 350 PSI |
| 1,750 RPM | 1" Shaft | 600°F | Heat Transfer Fluid | 50 PSI |
| 1,800 RPM | 1" Shaft | 200°F | Brine | 100 PSI |
| 60 RPM | ½" Shaft | 70°F | Sulfur Dioxide | 100 PSI |

**"SEALOL"– Sealed Gear Boxes & Speed Reducers**

| | | | | |
|---|---|---|---|---|
| 6,800 RPM | 5" Shaft | 125°F | Lube Oil | Atmos. Pressure |
| 18,000 RPM | 1¼" Shaft | 150°F | SAE 10 | 20 PSI |

**"SEALOL"– Sealed Agitators & Mixers**

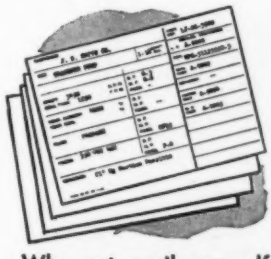
| | | | | |
|---|---|---|---|---|
| 80 RPM | 2¾" Shaft | 350°F | Steam and Hot Air | Atmos. Pressure |
| 300 RPM | 1" Shaft | 450°F | Acetone Vapor | 50 PSI |

**"SEALOL"– Sealed Gas Turbines**

| | | | | |
|---|---|---|---|---|
| 15,000 RPM | 1 3/16" Shaft | 300°F | Alcohol Vapor | 65 PSI |
| 7,700 RPM | 5¼" Shaft | 356°F | Lube Oil | 2 PSI |
| 53,000 RPM | 1" Shaft | 350°F | Oil and Steam | 350 PSI |

**"SEALOL"– Sealed Compressors & Super-Chargers**

| | | | | |
|---|---|---|---|---|
| 3,024 RPM | 3½" Shaft | 250°F | Oil Mist and Air | 7½" Hg. abs. |
| 70,000 RPM | ½" Shaft | 230°F | Oil Mist and Air | 19" Hg. abs. |



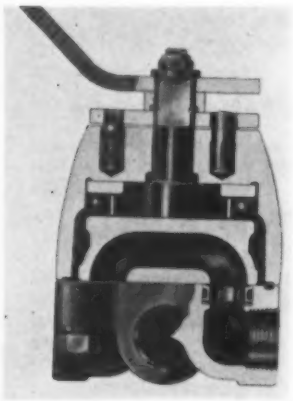
Also: washing machine pumps, dynamometers, boiler feed water pumps, drill press spindles, steam compressors, oscillating dryers, drying rolls, air chucks, natural gas flow meters, sea water pumps, water pumps.

Why not avail yourself of this fund of seal-engineering experience: Our Engineering Department is at your disposal. Send blueprints and specifications to Sealol Corporation, 45 Willard Ave., Providence 5, R. I.

**SEALOL**
Chicago • Cleveland • Detroit • Los Angeles
New York • San Francisco

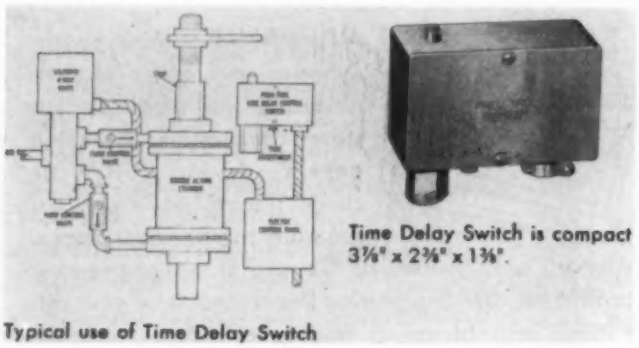
# application and performance of NEW COMPONENTS

**EXTREME PRESSURE VALVE** — The patented sealing principle employed in Barksdale Valves was specifically developed for extreme pressure control. It is commercially known as the "Shear-Seal" principle, pointing up the fact that to shear off the fluid flow requires the least amount of effort. A pressure balanced, self-aligning, tubular valve seat keeps perfect intimate contact with the mating surface of an optically flat porting disc. The rotary movement of this disc opens and closes the flow passages. During the absence of fluid pressures a heavy spring-washer maintains the contact between sealing surfaces, while a predetermined hydraulic force acts on the seal under extreme pressure. Fluid flow is always through the hole in the center of the seal, never across sealing surfaces. Production models of the new valve design, illustrated, cover a complete range of the following types and pressures: Shut-off valves from ¼ to 1½ in for pressures 0 to 6000 psi; 4-way dual pressure valves in two classes, (1) for 3000 psi maximum pressure, (2) for 6000 psi maximum pressure; manipulator valves from ⅜ to 1 in for pressures 0 to 1500 psi.



Circle 101 on Reader Service Card

**TIME DELAY CONTROL SWITCH** — A simple, positive, low cost time delay control switch for electric solenoid valve controls used with air or hydraulic cylinders, which permits time dwell from ¼ to 10 seconds has recently been developed by Pneu-Trol Devices, Inc. An important advantage claimed for the new switch is that its small size permits it to be mounted near the mechanical stop without interfering with machine movement. The switch automatically resets itself after each actuation. Time delay adjustments are easily made by turning the knurled adjustment screw, which moves the switch position in relation to the piston lever arm. The switch is being used to control machine dwell for spinning, blanking, spot-facing, drilling and tapping operations. Process work, such as plastic printing, rubber and plastic curing, burnishing, coating, quenching, dipping, etc., are other applications of the switch. The switch also provides dwell for fixture loading and unloading on high production operation.



Typical use of Time Delay Switch

Time Delay Switch is compact 3⅛" x 2⅜" x 1⅜".

Circle 102 on Reader Service Card

**ELECTRONIC STRAINALYZER** — A completely self-contained and modernized electronic instrument for the study of vibration, strain and dynamic stresses has been introduced by the Electronic Tube Corp. Known as the H-42A Strainalyzer, the unit records phenomena up to 50 kc and amplifies these weak signals up to 35000 times. It makes possible the simultaneous observation and recording of four separate traces on a single 5 in oscilloscope tube, each appearing in correct time relationship without the necessity of optical alignment.

Circle 103 on Reader Service Card

**AIR VIBRATOR** — Spo, Incorporated have announced the availability of the newly designed Series 79 air vibrators. These new units are available in eight standard sizes to meet a wide range of applications. Featuring excellent versatility, the series 79 air vibrators can be furnished with long stroke or with standard stroke piston to assure the correct intensity of transmitted power. Designed for operation on standard 80 psi line pressure, the air vibrators are recommended for use on hoppers, tables, molding machines, chutes, concrete block machines, and many other diversified types of production equipment. For hopper installations, these new vibrators can be used in conjunction with a quick-acting hopper-gate-valve, which actuates the vibrator only when the hopper discharge gate is open. Series 79 vibrator bodies are cast from semi-steel. The end-plate mounting bracket is held positively in place by one inch alloy steel bolts. The units employ a special bronze alloy cylinder liner which assures smooth, positive operation and provides for a long, maintenance free service.

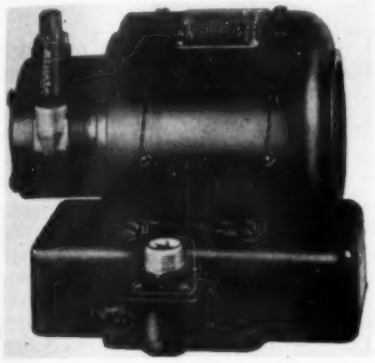
Circle 104 on Reader Service Card

**SELF-ADHESIVE METAL NAMEPLATE**—Introduction of a new self-adhesive metal nameplate requiring no pre-drilling of holes, screws, rivets or other fastening devices has been announced by the C & H Supply Company, Metal-Cal Division. Consisting of a .003 in thickness of aluminum foil anodized and dyed to

government specifications, Metal-Cals are backed with a high tensile bonding material and can be quickly applied to any smooth, cohesive surface. Permanent clarity and legibility of Metal-Cal letters and characters are claimed to be assured by the processing which makes them a part of the aluminum foil itself.

Circle 105 on Reader Service Card

**AIRCRAFT AIR COMPRESSOR** — Designed for positive operation at 50,000 feet altitude, this compressor built by Lear, Inc., Romec Division, is equipped with an alternating current motor of 1/5 hp, 115 volts, 400 cycle, single phase, 4 amperes, 7200 rpm. The minimum capacity at 50,000 feet is 80 cubic inches per minute while maintaining 32 inches Hg absolute pressure. Sea level capacity is 1.750 cubic inches of free air per minute. This air compressor is designated Type HD-70/U by the Air Force. Principal use is the pressurizing of radar installations in aircraft, maintaining an atmosphere of dry, oil-free air. The unit has a service of 1,000 hours with no decrease in performance. Sliding blades of rotary pump are self-lubricated carbon graphite composition which assure positive starting at minus 87 F. Total weight with outlet check valve is 5.1 pounds.

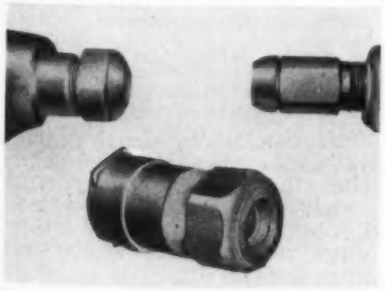


Circle 106 on Reader Service Card

**GRAVITY FEED OILERS**—Available in 10 oz, 1 pint, 1 quart and 2½ quart capacity pyrex glass or lucite plastic reservoirs, with lock ring or ratchet feed adjustment, these oilers, manufactured by Trico Fuse Mfg., Co. are designed to feed any predetermined number of drops per minute. They are especially recommended for applications on large stationary bearings, machinery and journals, wherever a large quantity of oil is required or when it is desirable to extend reservoir refilling time as long possible.

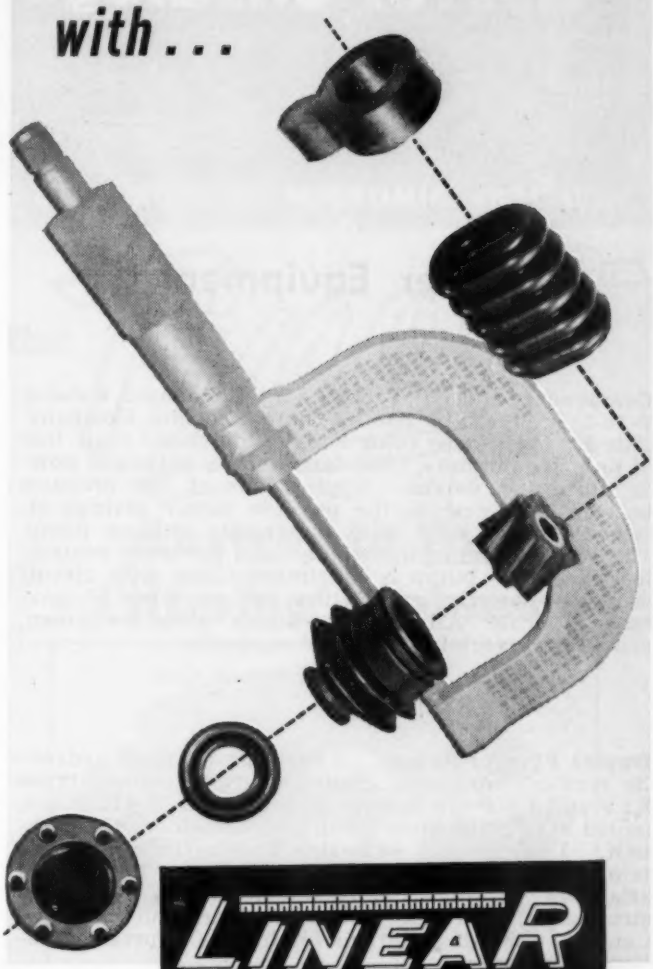
Circle 107 on Reader Service Card

**REVOLVING JOINT** — Developed by Rotherm Engineering Co., Inc., this replaceable cartridge type revolving joint cuts maintenance time to a minimum. Designed for hydraulic systems on rotating roll equipment as used in paper, textile and steel mills, the replaceable cartridge seats and is locked against two ball ends. One ball ended fitting is screwed into the roll to correct roll misalignment and becomes permanent. Piping misalignment is corrected by the second ball end which is permanently fixed in the piping. The cartridge assumes any position between the ball seats. A seal, inside the cartridge, holds the pressure and is spring loaded so the higher the pressure the tighter the seal. The coupling is available in three sizes: ½, ¾ and 1 in.



Circle 108 on Reader Service Card


Every Piece Counts
with . . .



LINEAR
PRECISION MOULDED PARTS

In these difficult times, few companies can afford to waste hard-to-get synthetic or natural rubber parts or to rework rejected assembled units due to faulty or cheaply made rubber pieces. With LINEAR precision mouldings held to the closest possible tolerances, EVERY PIECE COUNTS! This means for you:

* A lower rejection rate
* Easier installation
* Promised schedules maintained

So if you require seals or odd-shaped parts of natural or synthetic rubbers, fluorethylene polymers or silastics to precision dimensions, consult LINEAR during the design stage.

"PERFECTLY ENGINEERED PACKINGS"
LINEAR
LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA

Circle 40 on Reader Service Card

# Useful Catalogs and Bulletins

## available for reference

## Power Equipment

**Components for Oil Power . . .** Condensed Catalog P-10-D is offered by Racine Tool & Machine Company. This 18 page, three color booklet, describes their line of pressure boosters, vane type pumps, packaged power units and valves. Applications of the pressure booster clearly show the possible power savings attainable when used with a variable volume pump. The construction of the widely used governor controlled vane type pump is illustrated along with circuit drawings showing applications of six types of governor controls. All models of 4-way valves are shown, providing a variety of control methods.

Circle 110 on Reader Service Card

**Duplex Plunger Pumps . . .** For high pressure hydraulic service, horizontal duplex plunger pumps, types KLF and KMF are described in Bulletin W-412-B30A, issued by Worthington Pump and Machinery Corporation. Dimensional data size and ratings of these pumps are given; pressures to 6000 psi at 11 gpm are attainable. Cross-sectional drawings illustrate construction of bearings, valves, cylinders and plungers. Central station installations for hydraulic press operation are shown.

Circle 111 on Reader Service Card

**DC Motors and Generators . . .** A 19 page booklet, B-4595, describing the new Life-Line type SK dc motors and generators is available from Westinghouse Electric Corporation. It shows how the new design uses rolled steel frames, heavy steel brackets, steel angle feet, and prelubricated double-sealed ball bearings to provide added strength and long life without outages. The booklet pictures and discusses the use of cast brass brush-holders, stainless steel springs, and Melamine Moldarta molded rocker rings for maximum corrosion resistance in the brush-holder assembly. It describes the unit construction of field coils for ease of replacement. Tufvar insulated conductors are used, in the armature for toughness, flexibility and protection against heat, moisture, dirt and vibration. Also shown is the unique construction of the end turns, which causes a fan effect that provides a constant flow of air through the motor, preventing localized heating.

Circle 112 on Reader Service Card

**Controlled Power Pump . . .** Model P-100-C Hydropump, manufactured by Hydropower, Inc., is described in an available 4 page bulletin. Drawings and exploded views show the simple built-in control to change pump displacement and direction of discharge. The vane type construction features a rotating pressure ring which is claimed to reduce friction and wear. Available in foot mounted, flange mounted and stripped models, the pump will deliver 0 to 10 gpm in either direction with a rated continuous duty of 750 psi at 1750 rpm.

Circle 113 on Reader Service Card

**Hydraulic Cylinders . . .** Model 1008 having an 8 inch stroke and 3 in bore and model 1000 with 10¾ in stroke and 3 in bore are described in a catalog sheet offered by the Char-Lynn Company. These clevis ended cylinders are built to operate under pressures up to 1200 psi and are widely applied to agricultural equipment. Complete parts list and construction data are included on this sheet.

Circle 114 on Reader Service Card

**Power Pump and Motor . . .** Catalog sheet 3200Ch-1 prepared by Berry Motors, Inc., presents performance data on the 3200Ch series of high volume units which may be used as either pumps of fluid motors. Built for high volume low pressure applications available pump models rated at 500 psi offer deliveries of 60, 120, 180 and 240 gpm. The sheet includes dimensional data for these units which use the unique Berry construction for power generation.

Circle 115 on Reader Service Card

**Portable Power Equipment . . .** 32 page Catalog P-50 offered by Blackhawk Mfg., Co., describes the complete line of Porto-Power equipment. Here is handy, portable oil power ready to move anywhere in the shop to do many troublesome maintenance and assembly jobs. A hand pump capable of developing 10,000 psi is connected through flexible hose to a single acting ram. The catalog shows attachments which when threaded to the ram will perform such operations as lifting, testing and straightening. On the job photographs include applications in construction and on the farm as well as general shop work. Complete portable kits, available with rams from small 1½ ton capacity midgets to 50 ton units, are described along with many useful accessories.

Circle 116 on Reader Service Card

**Torque Actuator . . .** For applications requiring rotary power equal in either direction, through a 280 degree arc, Bulletin 20 describes the Hydromotor hydraulic torque actuator. This eight page bulletin shows construction features and application photos of the three standard models. Torque ratings from 10,000 inch pounds to 120,000 inch pounds at 1000 psi are available. Dimensional drawings and performance charts provide data for the proper selection of this unit.

Circle 117 on Reader Service Card

**Air Chucks and Cylinders . . .** A forty-four page catalog of power chucks, air cylinders and other air equipment has just been published by The S-P Manufacturing Corp. The new catalog is well illustrated with

cutaway pictures of the various models as well as photos of the equipment at work. Engineering drawings and complete reference tables make the catalog especially convenient for the draftsman as well as engineer. Eight models of non-rotating air cylinders are illustrated in designs to meet most application requirements.

Circle 118 on Reader Service Card

## Control Equipment

**Flow Regulating Valve . . .** Used to maintain a constant rate of flow in one direction in an oil line but permit free flow in the opposite direction, Hydraulic Equipment Company's VF 3 valve series is described in Bulletin sheet VF 102. A cross-sectional drawing clearly shows the construction of this hollow plunger type valve. Method of operation of this valve, which will handle a free flow capacity of 25 gpm at the maximum operating pressure of 1000 psi, is discussed.

Circle 119 on Reader Service Card

**Hand and Foot Air Valves . . .** A new technical Bulletin, designated No. 303, has been issued by Ross Operating Valve Company to describe its ¼ and ⅜ in 880 Series hand and foot valves. Installation data, engineering drawings and explanations of interchangeability of parts and ease of modification are included. The 880 series was developed for quick control of small cylinders and for pilot operation of master valves.

Circle 120 on Reader Service Card

**Relief Valves . . .** A new line of relief valves is described in Vinson Manufacturing Co's Bulletin 6000. This balanced outlet valve is not affected by pressure changes or surges down stream. Dynamic test results on a valve showed cracking pressure of 1500 psi, full flow at 1505 psi and reseat at 1450 psi. Manufactured in four sizes ¼, ⅜, ½ and ¾ in, the valve can be used in sequencing systems, as "cheater" valves, and in a unique two relief version, may be used as a thermal relief valve.

Circle 121 on Reader Service Card

**Air and Oil Valves . . .** Fourteen models of valves for actuating air and oil cylinders are described in the new Bulletin 510 issued by the Ledeen Mfg., Co. Dimensions and weights are charted and circuit drawings showing the installation of 2-, 3-, and 4-way connected valves are included. The 14 models are offered in 5 different cycles and 6 sizes. They may be operated by foot, hand, solenoid, pilot or cylinder travel, making them extremely versatile and providing the user with a wide range of flexibility in designing his circuit.

Circle 122 on Reader Service Card

## System Accessories

**Ball Joints . . .** "Flexible Ball Joints" is the title of a new 16 page bulletin which has just been published by Barco Manufacturing Company. The Barco ball joint is a versatile fitting providing flexibility in pip-

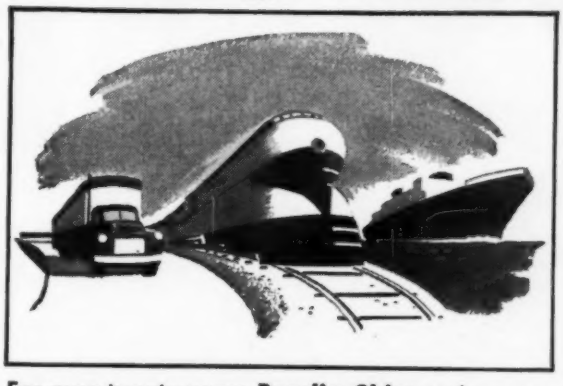
*(Continued on page 64)*


**Bendix-Skinner**

ORIGINATOR OF **MICRONIC** FILTRATION

the *Finest*

**Answer to Any Filtering Problem**



For over twenty years ***Bendix-Skinner*** has specialized in solving the filtering problems that "couldn't be done." From this experience has come entirely new and exclusive filtering techniques which do even the work-a-day filtering jobs better and at lower long-range cost. Tell us about *your* problem—nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer.

***Over 350 Models** providing filtration from ½ micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*

SKINNER PURIFIERS DIVISION OF
1503 TROMBLY AVENUE,
DETROIT 11, MICHIGAN
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

Circle 41 on Reader Service Card

# Now you can make tube and pipe connections at 1000 psi and above with . . .

## NO FLARING, NO THREADING, NO WELDING, NO SOLDERING!

## Use Weatherhead

# "ERMETO"®

## FITTINGS

**The patented design of the Weatherhead Ermeto Fitting permits installation with no tools but a wrench, easy disassembly, and retightening with a pressure-tight joint.**

*Ermeto meets J. I. C. requirements*

## Meeting Aircraft Requirements Makes *Quality* A Weatherhead *Habit*

Research in vibration has taught us how to distribute loads, avoid stress points. Research in high pressure has taught us the design and metallurgical factors which mean safety up to 40,000 psi. Constant laboratory work at high and low temperatures has taught us what to expect in joints under all temperature conditions. Serving the needs of many industries has aided us in developing fittings for the high demands of corrosion resistance.

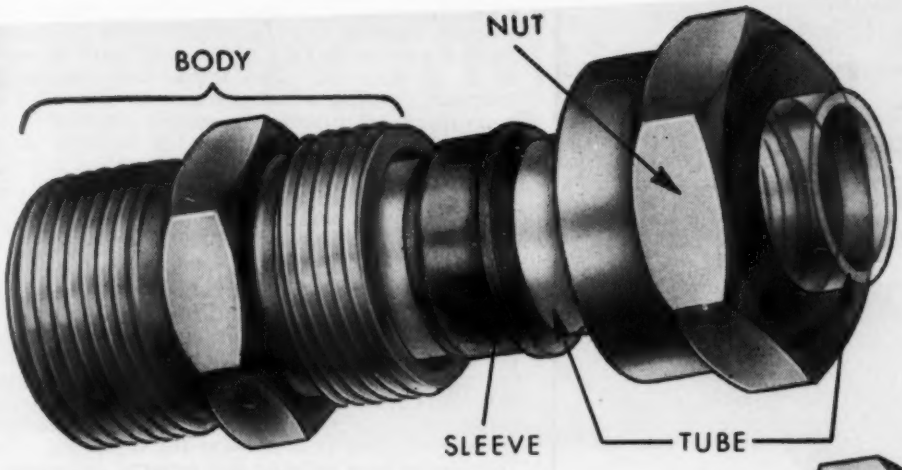
This knowledge, as it helps solve aircraft and other special problems . . . where fittings demands are extreme . . . also has guided the design and production of all the fittings that are "standard" in the Weatherhead line.

*The Mark of Quality*

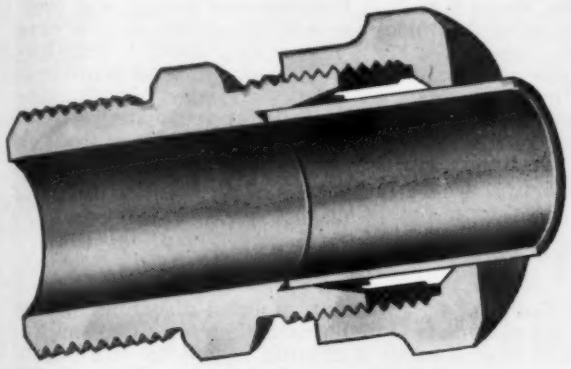
# WEATHERHEAD

## FIRST IN HYDRAULIC CONNECTIONS

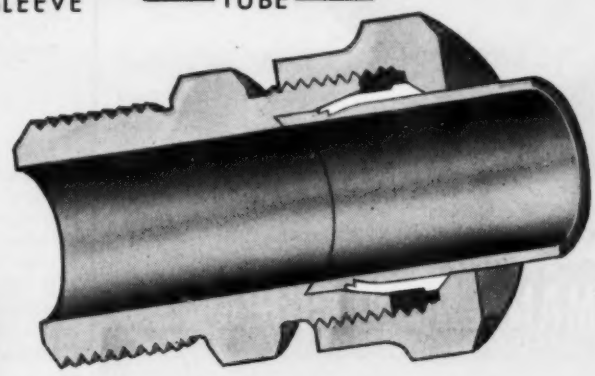
Plants at Cleveland, Ohio; Angola and Columbia City, Indiana; and St. Thomas, Ontario




**1** The hardened sleeve is the heart of the Ermeto fitting. The sleeve and nut are slipped on the tube; end of tube is inserted into body of fitting.



**2** As nut is tightened, the pilot of the sleeve contracts, engaging outer surface of tube.



**3** Fully tightened. Tube end butts tight against body shoulder.

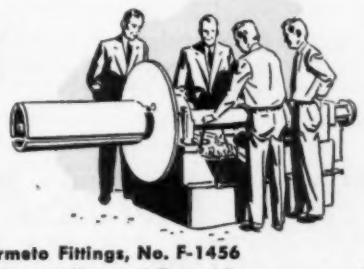
Nut presses sleeve bevel, causing entire sleeve to clamp the tube. This strengthens seal and distributes vibration strains.

Forces acting on sleeve cause it to bow slightly, giving it a spring action which holds constant tension between the body and the nut—prevents loosening.

DESIGNED for high-pressure use, the Ermeto fitting has so simplified and cut costs on all tube connections that many manufacturers are standardizing on ERMETO FOR ALL JOINTS. The advantages in terms of simplified inventories, are obvious. Made in steel, stainless steel and brass—sizes from ⅛" to 2" O. D. Get full information now! Write on company letterhead for catalog #E-1457. The Weatherhead Company, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.

**DESIGN ENGINEERS**—can forget psi when they specify... ERMETO! Meets J. I. C. requirements. Designed for high pressures, economical for low pressures because of simplified inventory when used for all joints!

**PRODUCTION AND MAINTENANCE ENGINEERS**—Ermeto installs quick and easy—no tools but a wrench. Easy to take apart and can be retightened with a pressure-tight joint. No production holdups due to involved flaring, threading, welding or soldering of joints.



**Get complete details now—write for catalogs No. E-1457 on Ermeto Fittings, No. F-1456 on Standard Weatherhead Fittings and No. H-1451-A on Hose Assemblies and Reusable Hose Ends.** ***Address—The Weatherhead Company, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.***

Circle 43 on Reader Service Card

**Protect HYDRAULIC EQUIPMENT**

**WITH HIGH PRESSURE**

**MICRONIC FILTERS**

• 3000 p.s.i. Operating Pressure, Micronic Filtration, Low Pressure differential, Compact in Line Type

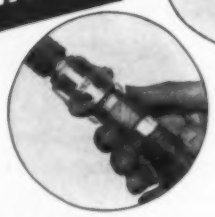
• Maximum Protection at minimum cost. Replaceable element.

West Coast: H. E. Webb
918 N. Kenilworth Ave., Glendale, Calif.

**WATERMAN ENGINEERING** *Company*

721 CUSTER AVENUE • EVANSTON, ILLINOIS

**Quick-As-Wink** AIR AND HYDRAULIC **Control Valves**



Valve Closed to Live Air— Open to Exhaust

Valve Open to Live Air— Coupling Locked

***VALVE COUPLINGS*** ¼", ⅜", ½", & ¾" SIZES

**For Economy and Safety**

• These couplings permit air to be shut off and tools changed quickly without going to the main shut-off valve. Coupling jaws are automatically self-locking when valve is open to air supply. The coupling cannot be disconnected until the valve sleeve is moved to closed and exhaust position,— thus preventing accidents and injuries. Pressures to 250 p.s.i.— hose shank, male or female pipe connections. *Send for Bulletin No. 104-C. It gives full details and prices.*

**Quick-As-Wink** AIR AND HYDRAULIC **Control Valves**

*Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated*

*Mfd.* by C. B. HUNT & SON, INC., 1966 E. Pershing St., Salem, Ohio

ing. Basically, it consists of a short pipe nipple terminating in an enlarged hemispherical section or ball which is housed inside an outer casing between two molded gaskets. This construction permits rotation as well as side flexing of the ball part in any direction up to 40 degrees. The joints are commonly used to overcome piping misalignment, to allow for settling or movement of piping, to guard against vibration or shock, to permit movement of loading or unloading lines, and for many other applications.

Circle 123 on Reader Service Card

**Piston Rings . . .** Three "abbreviated" catalogs—two, eight pages in length, and one, 12 pages—are now obtainable from the Double Seal Ring Company. The catalogs list products of three of the firm's manufacturing divisions: piston rings, metallic rod packing and Bakelite products. Each of the well illustrated pamphlets describes the products and their uses fully and gives complete instructions for ordering. Included in the piston ring catalog are several drawings of typical ring installations.

Circle 124 on Reader Service Card

**Flexible Metal Hose . . .** Dimensional weight and pressure data of flexible hose are tabulated in a 4 page bulletin issued by the Flexpansion Corp. This bellows-type non-braided, braided or braided with flexible armor hose will withstand pressures which make it suitable for many pneumatic and oil applications. Simple, pressure-tight, threaded and compression couplings which can be installed without packing or welding, are illustrated.

Circle 125 on Reader Service Card

**Quick Couplings . . .** Quick connect-disconnect couplings for aircraft and industrial hydraulic applications are described in a catalog issued by Roylyn Incorporated. Available in aluminum alloy, carbon steel, stainless steel, alloy steel and brass, working pressures for each material are tabulated. The working principle is explained; dimensional and style data presented. Couplings and nipples are made in size range from ¼ to 6 inches.

Circle 126 on Reader Service Card

**"O" Ring Data . . .** Designers and users of "O" ring seals will find the data notebook, which has been prepared by the Plastic and Rubber Products Company to be a valuable addition to their working library. Basic design data is provided for the proper determination of ring sizes, permissable squeeze, groove tolerance, and other critical machining dimensions. The use of anti-extrusion devices or backup rings for high pressures is explained. Dynamic sealing uses of "O" rings in cylinders, valves and couplings are shown along with typical static sealing jobs. To assist in the selection of the proper compound, test reports are given. Results present aging qualities, compression set, and tensile, elongation and hardness properties. Applications requiring cup packings are described with installation drawings.

Circle 127 on Reader Service Card

**Flexible Coupling . . .** The Ajax Flexible Coupling Co., Inc. offers a fully illustrated folder which describes the operation of their new dihedral coupling. A cutaway view of the coupling shows how it handles up to 7 degrees misalignment. The unique dihedral shape of the involute spline provides for the maximum amount of misalignment with minimum clearance or backlash. Sizes and service factors are listed.

Circle 128 on Reader Service Card



Circle 44 on Reader Service Card

# ANCHOR

## Assembled Hydraulic Hose Units

# *Tailor-made to Keep Your Costs Down–Performance Up*

## Factory-assembled to your specifications—save you time and money, give you a better job

**For extra protection against leaks and blow-offs at high pressures use factory-applied Anchor Ductile Sleeve Hose Couplings with their exclusive patented grip.**

**Anchor adapter unions save assembly time and piping expense. Use them and other styles of related Anchor fittings to simplify your piping problems.**

FOR longer service life — you design your machines with great care and manufacture them to rigid tolerances.

But the job is not done until you invest the same care in selecting and specifying hose units. After all, the performance of your machines is dependent upon them.

That's why Anchor offers factory-assembled hose units. They are made to exact lengths in accordance with your drawings. And the couplings are factory-applied by experts with specially designed machines to give you leakproof dependability and extra safety. They cost less in the long run — because they give better service, keep your customers satisfied.

Shown here is a rayon two-braid hose-assembly designed for medium and low pressures. Made from specially selected synthetic rubber, it has excellent flexibility. This same unit is also available in a single-wire braid hose.

For high pressures Anchor Ductile-sleeve hose-couplings are your best choice.

Take out performance insurance. Reduce assembly time and costs in your plant and in the field. Equip your machines with Anchor factory-assembled hose units.

Send for complete information on Anchor assembled hose units.

**Tear out this coupon and mail TODAY!**

**ANCHOR COUPLING CO. INC.**, Dept. A-H31
Libertyville, Illinois

I like the dependability, the safety, and the time-and-money-saving features of Anchor Assembled Hose Units. Please send me Bulletin No. 493.

Name..... Position.....

Company.....

Company Address.....

City..... (.....) State.....

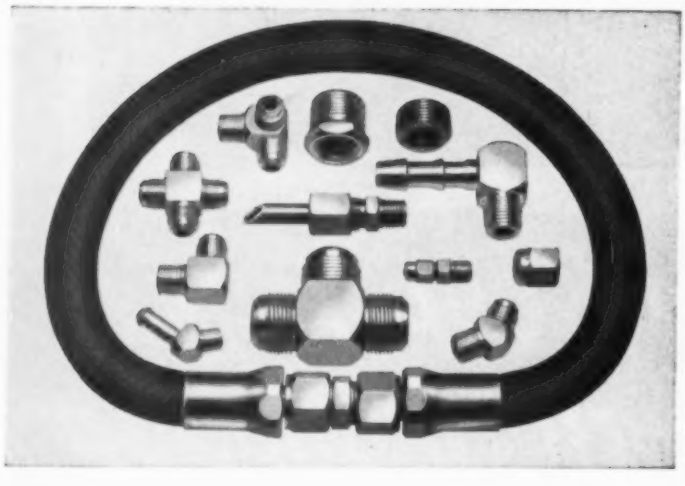
D-2

**ANCHOR COUPLING CO. INC.**
Factory: Libertyville, Illinois • Branch Detroit, Michigan

WHEN YOU CHANGE TO

# J. I. C. Standards

LET L & L SERVE YOUR HYDRAULIC PIPING NEEDS



- **STEEL TUBE COUPLINGS**

  for ⅛th to 2 inch O.D. tubing
  2 PIECE TITE-SEAL FOR ECONOMY
  3 PIECE LOCK-JOINT-SLEEVE TYPE

- **HOSE ASSEMBLIES**

  with pressed-on coupling for single and double wire braid hose

- **PIPE FITTINGS**

  Straight, Ells and Tees with "Dryseal" pipe threads (N.P.T.F.)

- **PRE-FABRICATING TUBES**

  Let us estimate your preformed tube assembly needs.

• Your installation problems are solicited. Write for catalog and technical data. We also have technical and sales representatives in your area for your convenience. All standard items are shipped from stock the same day your order is received. Excellent service on "'Specials".

*Hydraulic Accessories*

**L & L Manufacturing Co.**

8088 EAST NINE MILE RD. VAN DYKE, MICH.


**Flow Indicator** . . . A new direct connected differential pressure instrument which converts main-line flow into proportional air pressure and transmits this air pressure to remotely located recorders to indicate flow or differential pressure, is described in 10 page Catalog 42, issued by the Fischer & Porter Company. The unit is designed to combine the advantages of the area meter and the orifice meter and eliminate the disadvantages of each.

Circle 129 on Reader Service Card

**Precision Electrical Switches for Control Circuits** . . . Catalog 50-05 offered by Unimax Switch Division of the W. L. Maxson Corporation presents specifications on their small sensitive switches. Travel definitions are clarified with drawings force and movement are tabulated and complete electrical ratings are given. Each type of switch is pictured and dimensionally laid out to assist the design engineer.

Circle 130 on Reader Service Card

**Filters** . . . Using a "Honeycomb" filter tube, the applications of Fulflo filters, manufactured by Commercial Filters Corporation are shown in an available bulletin. Standard models for compressed air systems handle 10, 30 and 60 cfm. Filters are also designed to clarify hydraulic fluids. Construction of the honeycomb tube consists of a specially processed cotton cellulose wound on an open metal core to form a thick cylindrical wall transversed radially by a network of diamond shaped passages. This "depth filtration" element is fully described in the bulletin. In operation, the fluid, in the course of its flow through the network of diamond shaped passages is forced from the outer wall of the element to the inner core and passes through a series of progressively denser webs of fine cotton fibers, the coarser impurities being removed by the webs on the surface of the element and the finer particles by the denser inner webs.

Circle 131 on Reader Service Card

**Liquid Line Filter** . . . Marvel Engineering Company describes their line type synclinal filters in Bulletin 202. These filters are enclosed in housings with suitable connections for mounting in the pipe line. Operating in any position, six sizes handling from 5 to 50 gpm with pipe sizes from ¾ to 2 in are available. Parts drawings show the simplicity of design of this easy to clean mesh-type filter.

Circle 132 on Reader Service Card

**Mechanical Seals for Rotary Shafts** . . . In a 12 page, three color catalog which is well illustrated with cutaway drawings, The Garlock Packing Company, describes their line of mechanical seals. Three standard constructions: package seal, chevron type seal and "O" ring seal are offered to provide leakless operation on rotary pumps operating at high speeds and pressures. Each of the three styles are fully described. Construction, specific applications and standard sizes are detailed. Complete dimensional data is provided to assist in drawing layouts and the determination of shaft and housing sizes. Installation service data are included along with two pages of line drawings showing 8 typical applications of mechanical seals.

Circle 133 on Reader Service Card

**Seamless Steel Tubing** . . . Pressure tubing for use in heat exchangers and hydraulic lines is described in a Bulletin offered by Michigan Seamless Tube Company. Specifications, analyses, shapes and sizes, permissible variations and standard steels are detailed.

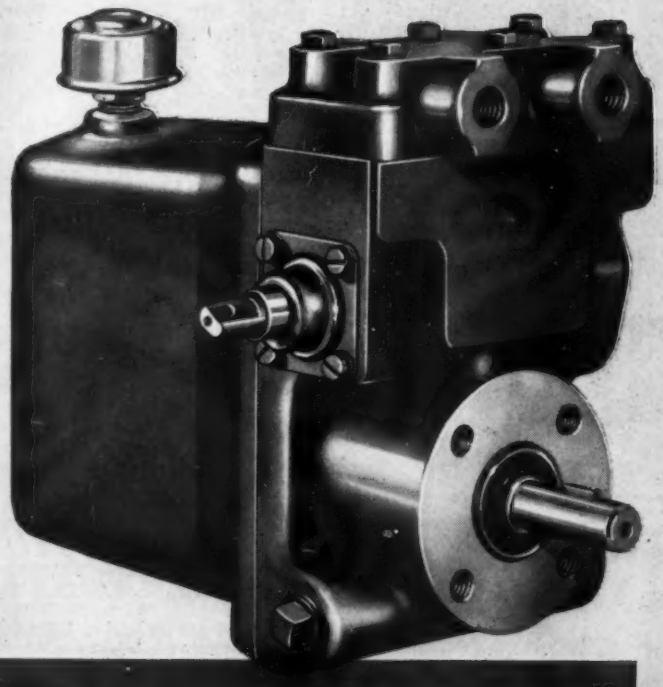
Circle 134 on Reader Service Card



Circle 74 on Reader Service Card

# The Hydraulic "Package" of a THOUSAND USES

# VICKERS POWER PACK



## *Simplifies Hydraulic Design*

## *Saves Money, Space and Time*

These three applications of the Vickers Power Pack indicate something of the extremely wide usage range of this hydraulic package.

Manufacturers have found it ideally suited to the largest variety of mobile as well as many stationary installations. It provides a compact, self-contained hydraulic system which is quickly and easily installed at low cost. Pump, relief valve, operating valves, oil tank and oil filter are all contained in the rugged, compact unit.

Vickers Power Pack is used on planters, cultivators, plows, stackers, loaders, harvesters, rakes, mowers, dump hoists, lifting tailgates, light duty scrapers, fork lift trucks, loaders, scoops, snow plows, etc. Check into its advantages for your accessory power source.

***WRITE FOR BULLETIN 46-48***

**VICKERS Incorporated**

*DIVISION OF THE SPERRY CORPORATION*

**1474 OAKMAN BLVD. • DETROIT 32, MICH.**

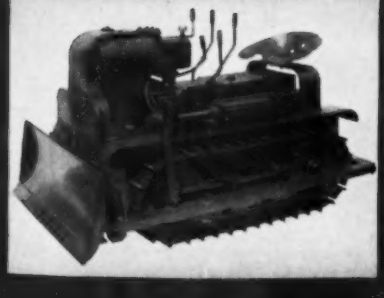
***Application Engineering Offices:*** **ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) NEW YORK (Metropolitan) • PHILADELPHIA • PITTSBURGH • ROCHESTER ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER**

***ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921***

4434

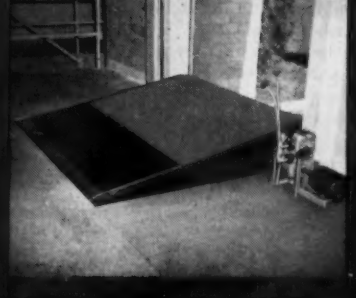
**OLIVER COMBINE**

Vickers Hydraulic Power Pack provides fingertip, instant control of the twin-cylinder harvester control.



**WILLCO J-7 CRAWLER TRACTOR**

This powerful little general purpose tractor uses Vickers Hydraulic Power Pack for fingertip control of bulldozer blade (46" wide x 18" deep) and other attachments.



**BEACON DOCK RAMP**

Vickers Hydraulic Power Pack powers vertical movement (24") to level with truck or freight car floors . . . also horizontal movement (14") where outer doors must seal when board not in use.

Circle 51 on Reader Service Card


★ REDUCE DOWNTIME WITH HILCO

HYDRAULIC OIL FILTERS...

THEY KEEP YOUR OIL CLEAN BY REMOVING PRODUCTS OF OXIDATION, ACIDS, SLUDGE AND MOISTURE

HILCO FILTERS WILL PREVENT SLUDGING, PUMP AND VALVE FAILURES...

★ WRITE FOR FREE LITERATURE AND RECOMMENDATIONS

THE HILLIARD CORPORATION
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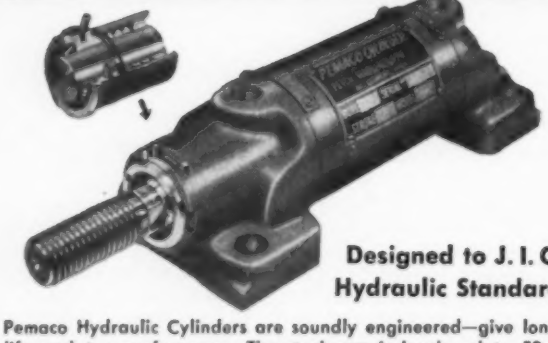
990 BAY ST., TORONTO-3464 PARK AVE., MONTREAL



PEMACO HYDRAULIC AND AIR CYLINDERS
with the NEW
Cartridge Type Packing Gland



Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine—and by inexperienced help—greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

PETCH MANUFACTURING COMPANY

Write for complete information and engineering data.

36100 HARPER AVE.
MT. CLEMENS, MICH.


**Tube Rolling Equipment** . . . A full description of the John Crane Tube Rolling Control and its correct application are shown in an eight page catalog. Designed to fix tubes in heat exchangers by expanding and rolling the ends, the precision control prevents tube and sheet damage by applying a controlled torque for the given material and size of tube. The control of torque is applied through an electrical device which is calibrated for a range of tube sizes and materials. The expander is a motor driven tool.

Circle 137 on Reader Service Card

**Stainless Tube Bending Slide Chart** . . . A slide chart presenting data on desirable minimum radii for economical bending of stainless tubing and pipe has been prepared by The Carpenter Steel Company, Alloy Tube Division. The chart covers stainless steel tubing ranging from ⅜ to 5 in O.D. size, in BW Gauges from 22 through 11. Radii are given for machine bends with and without mandrels of 90 and 180 degrees. Stainless pipe schedules 5, 10 and 40 are described, and recommended coil diameters for stainless pipe from ⅛ in to 4 in are included. The chart also contains tables of standard sizes for round stainless tubing and pipe, a table for determining theoretical bursting pressures, and a table of analyses and physical properties for various types of stainless tubing.

Circle 138 on Reader Service Card

**Guide to Motor Selection** . . . Quick reference to data on general purpose electric motors is supplied in Allis-Chalmers' Bulletin 51B6052. The handy 12 page guide includes application data, NEMA specifications, speed torque curves and construction features.

Circle 139 on Reader Service Card


SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN
#29 HYDRAULIC CYLINDER
Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 37.50

HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" . . . . 5.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15⅝" . . . 8.50
NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" . . . . . 15.75

AN-Hi-PRESS. HOSE (FUEL – OIL & AIR)
1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each.
Same as above but 67" long. . . . . $3.75 each.
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.
Same as above but 36" long. . . . . $2.95 each.

FOUR WAY VALVE

V-2B – Poppet Type. Off at neutral position. 3/8" AC Tube Ports – (9/16 - 20) thread. P.S.I. 1,500 . . . . . 4.75
V-17 – Poppet Type. Pressure balanced. Offset neutral position. Piston type with built-in relief valves for limit of cylinder strokes. ½" Standard pipe inlet & outlet ports. ½" AC tube to cylinder (¾" - 18) thread tapped ports. NEW 8.75

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

HYDRAULIC TRANSMISSION

Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 37.50

HYDRAULIC PUMPS

ANGLE PUMP
Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW 17.50

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotation either direction without adjustments. NEW 17.50

GEROTOR TYPE PUMP

Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. Now ONLY 22.50

PALLEY SUPPLY COMPANY
6321 SAN FERNANDO RD.
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GLENDALE 1, CALIF.

– WRITE FOR 1951 CATALOG –
OVER 200 PAGES OF BARGAINS
in machine tools (taps, drills, dies, reamers, etc.). Hydraulic Cylinders, Valves, Pumps & Motors. Air Tools & Bearings.

Circle 73 on Reader Service Card

# APPLICATIONS UNLIMITED for BECKETT-ENGINEERED *PACKAGED* AIR CONTROLS

New HI-CYCLIC Air Valves convert D.C.M.T. Diecaster from hand to full automatic operation.

***NOW AVAILABLE***— Packaged Air Controls for practically any machine tool or production unit. Here is sensitive, accurate, flexible and LOW COST air control —made possible by new HI-CYCLIC Air Valves.

Beckett Packaged Air Controls are now installed on the small D.C.M.T. Model M55A Diecaster, converting it from hand to full automatic or semi-automatic operation. Dies are closed and shot is made automatically, with any degree of time dwell on die closing or shot injection. Controls are safety-interlocked. Provision has been made to automatically lubricate and clean flash from the dies after each shot. Beckett controls are compact, accessible —will be installed on new D.C.M.T. Diecasters and are available for existing machines.

Investigate this new development in air engineering. Convert to automatic operation this accurate, low-cost way. Write for bulletins describing HI-CYCLIC Air Valves and Packaged Air Controls.

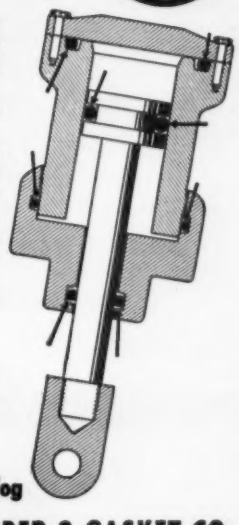
**BECKETT-HARCUM CO.** 1145 Wayne Road, Wilmington, Ohio

Circle 53 on Reader Service Card

# O-RINGS by INJECTION MOLDING

## *Dependable Hydraulic Seals*

Minnesota O-Rings function in air or gas systems as well as in hydraulic systems. Air cylinders . . . hydraulic valves . . . hoisting mechanisms . . . water pumps . . . bottling machines . . . refrigerators . . . motors . . . lubricators . . . are a few of their uses. Minnesota's exclusive injection process makes possible very close dimensions, uniformity in mass production and downright economy. We use special compounds of synthetic rubber to meet your exact requirements. Let us quote on your next hydraulic packing installation.



*Manufacturers of all types of small rubber parts*

**Write for O-Ring Catalog**

**MINNESOTA RUBBER & GASKET CO.**
**3642 WOODDALE AVE., MINNEAPOLIS 16, MINN.**

# STOP downtime and expensive repairs on your HYDRAULIC equipment

**GET THIS HONAN-CRANE BULLETIN NOW!**

Tells how Honan-Crane Hydraulic Oil Purifiers, by continuous removal of contamination from oil—

- prevent excessive wear of hydraulic pump parts
- prevent clogging and sticking of control valves, pistons, and other hydraulic mechanisms
- provide longer safe use of hydraulic oils
- greatly reduce oil consumption

**also** gives correct applications of Honan-Crane Hydraulic Oil Purifiers to all types of hydraulic equipment.

*Savings in oil alone pays cost of installing Honan-Crane Hydraulic Oil Purifiers*

HONAN-CRANE CORPORATION
**102 Wabash Avenue, Lebanon, Indiana**
*a subsidiary of*
HOUDAILLE-HERSHEY CORP.

Circle 55 on Reader Service Card

**"Parco"** is a trade name to rely on for better "O" rings. Better because the material used is precision compounded and fabricated by men with years of experience. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-P-5510 (6290) are available from stock. Silastics, Kel-F, and other special compounds are available on order.

*Catalog and engineering data on request. Write us today.*

**Plastic and Rubber Products Company**
2100 Hyde Park Blvd., Los Angeles 47, Calif.
919 No. Michigan Ave., Chicago, Ill.

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## Advertisers' Literature

*(Continued from page 6)*

MINNESOTA RUBBER & GASKET CO. "O" ring Catalog details this line of injection molded packings.

Circle 53 on Reader Service Card

W. H. NICHOLSON & CO. A line of valves for air and oil, for pressures to 5000 psi, is described in Catalog 546-A.

Circle 48 on Reader Service Card

ORTMAN-MILLER MACHINE CO., INC. Time-saving design templates are offered to assist in the layout of equipment using cylinders and mounting brackets. A complete set covering all sizes from 1½ in to 8 in bores will be supplied.

Circle 69 on Reader Service Card

ROSS HEATER & MFG. CO., INC. Application data offers suggestions for use of heat exchangers on hydraulic equipment.

Circle 18 on Reader Service Card

# THE MARKET PLACE

## CLASSIFIED ADVERTISING

**Rates: For "Positions Wanted" $4.00 minimum, limit 25 words. For all other classifications $4.50 minimum for 25 words, each additional word 15c; bold face type or all capitals, $7.50 minimum for 25 words, each additional word 20c; limit 50 words. Box addresses count as five words.**

**MECHANICAL AND HYDRAULIC ENGINEER**

Should have experience on industrial hydraulic circuits and machine design. Prefer mechanical engineering degree from accredited school but will accept mechanical and hydraulic experience in its place. Should have basic knowledge of electrical circuits as applied to machine tools in conjunction with electrically controlled hydraulic equipment. Will be in charge of industrial hydraulic design problems directly under Chief Engineer. Location — Southern California. State fully educational background and experience, draft status and salary expected. Write **Box 3251**, APPLIED HYDRAULICS.

**SALES ENGINEER**

**To sell industrial hydraulic equipment in Los Angeles County**

Should have experience on industrial hydraulic circuits. Some machine design experience desirable but not required. Prefer mechanical engineering degree from accredited school but will accept mechanical and hydraulic experience in its place. Must be energetic, present nice appearance, have good personality and be intelligent. Top salary plus car allowance. State fully educational background and experience, draft status and salary expected. Enclose picture with application. Write **Box 3351**, APPLIED HYDRAULICS.

## Air Conversion

*(Continued from page 38)*

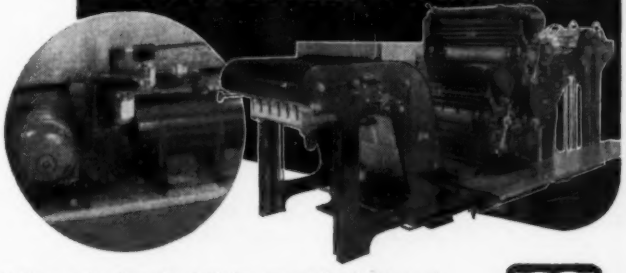
slides. The cutting speed can be controlled by means of a regulating valve, which can be adjusted for speeds from zero to rapid travel.

After the cut-off is made, the pilot valves of the master control valve are tripped, reversing the air, giving a quick return to the tools and bringing up the stock stop. This movement opens the switch on the stock stop, deenergizing the collet control valve and opens the collet. As the pressure builds up, the feed rolls, which rotate continuously, are closed on the stock. The next cycle starts with the stock being fed through the spindle.

To facilitate setting up of the machine a control unit, consisting of a 4-way valve, pressure gauge, pressure regulator, lubricator and filter, is placed in the air line. The 4-way valve has three operating positions. In the first position, the valve shuts off all cylinders; the second position it furnishes air to the collet control cylinder, leaving the cross slide on exhaust; and in the third position it furnishes air to all cylinders. The second position allows the collet to be locked and the cross slides to be moved by hand. The third position is the normal position for automatic operation.

Circle 56 on Reader Service Card

engineers at Harris-Seybold chose GAST AIR PUMPS for three OFFSET PRESSES



Before adopting Gast Units, Harris-Seybold engineers put these rotary Air Pumps through their paces! In the factory, and in actual press rooms, careful checks were made on performance, construction, and dependability. And Gast Air Pumps proved their merits!

As a result, they are now standard equipment on 3 Harris-Seybold models, including their 22 x 34 two-color offset press.

Yes, there's a trend to Gast Air Pumps for presses and printing equipment . . . and for scores of other applications where trouble-free performance is vital. Write Gast, describing your original equipment problem. "Air may be your Answer!"

see our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

Have you seen Gast Application Ideas booklet, showing 26 product problems and solutions? Sent on request.

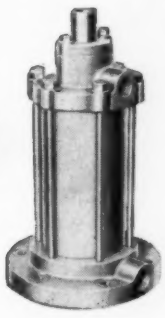
Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

Tell Us Your Production Problems . . . We'll Help You Solve Them

"LOGAN" HYDRAULIC CYLINDERS
SAVE TIME EFFORT MOTION

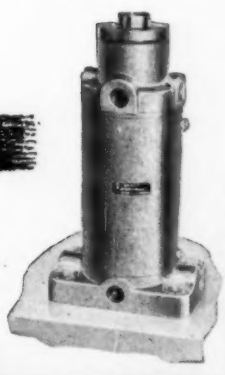
Here's fast-acting, positive controlled power for all types of industrial applications. . . .



LOGAN 750 SERIES

ROTATING TYPE—Seven standard sizes from 3" to 14" diameter bore. Larger sizes special to order. Maximum operating pressure 500 p.s.i.

NON-ROTATING TYPE—Eight standard sizes from 2" to 8" diameter bore. Larger sizes special to order. Maximum operating pressure 750 p.s.i.



LOGAN ROTOCAST® SERIES

7 STANDARD MOUNTINGS

Sizes from 2" to 8" bore; any length stroke up to 8 feet. Other bores and lengths are special. Four piston rod end types. Operating pressures to 1500 p.s.i.

FLUID POWER SPECIALISTS SINCE 1916

Logan Manufactures 6,975 Standard Cataloged Items

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COLLET GRIP TUBE FITTINGS — CATALOG 44
HYDRAULIC CONTROL VALVES — CATALOG 200-4
HYDRAULIC CYLINDERS — CATALOG 200-2; ALSO 80-2
HYDRAULIC POWER UNITS — CATALOG 200-1
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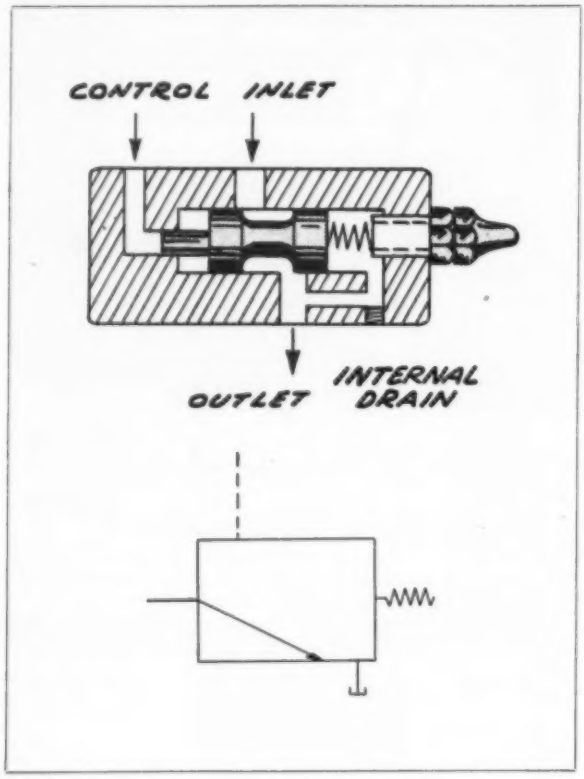
Let Logan Engineers help you design your Air and Hydraulic Circuits.

Logan SAVES * TIME * EFFORT * MOTION
Air and Hydraulic Equipment

LOGANSPORT MACHINE CO. INC. 832 Center Ave. Logansport, Ind.

# Know Your Component Symbols




## UNLOADING VALVES

Hydraulic Series

*The third in a series showing the symbol and a typical schematic of the valve it represents.*

**Unloading valves** are used to "dump" the pump capacity back to the reservoir at near zero pressure, between cycles. This function is important because it increases the efficiency of the system by removing the pump load when pressure is not required.

During the work cycle, flow to the pressure inlet is blocked until pressure applied at the remote pressure control connection at the lower end of the piston overcomes the opposing spring force. Oil is then discharged at atmospheric pressure.

Unloading valves may also be manually or solenoid actuated; the purpose and principle of each is similar.

***Standards File Sheet***


The ANSWER to controlling air electrically!

MODEL NE Electric VALVE

**10 WATT SOLENOIDS**—Low power requirements. No relays, no transformers required. Operates directly off regular 110 or 220 v. circuits. Solenoids continuously rated.

**FAST, EFFORTLESS CONTROL**—Works by push button, limit switch, or any light contact. Only momentary contact needed. Ideal for remote control . . . interlock or sequence operation . . . building into equipment.

**DISC TYPE**—Pilot controlled; piston operated. Metal-to-metal seat; positively air-tight. Quiet, self-lapping, long lasting. No packing or seals to maintain.

**HANNIFIN ENGINEERED**—Small, rugged, self-contained. Type 1 for control of advance and return cylinder strokes through separate push buttons. Type 2 for single push button control—equivalent to spring return valve action. Sizes ⅜", ½", and ¾". 25 to 150 p.s.i.

*Ask for Bulletin 230*

HANNIFIN Corporation

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Nationwide Sales and Service

"SEAL-GUARD" METALLIC ROD WIPER

PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

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# Speed will be the essence of most new contracts

## CUSHMAN HIGH SPEED ALUMINUM BODY CHUCKS *and* AIR CYLINDERS

When you get down to tooling and equipment problems on new production schedules, be sure to consider the entirely new field opened by power chucks and air cylinders designed to operate smoothly and dependably at speeds up to 3500 r.p.m.

These Cushman Aluminum Body Chucks and Cylinders have been fully tested in everyday production line service. They're tough, dependable and trouble-free, require little or no maintenance, can contribute substantially to meeting high output demands. Available in limited quantity for essential needs. Anticipate your requirements and contact us at once.

**THE CUSHMAN CHUCK COMPANY**
**HARTFORD 2, CONNECTICUT**

# CUSHMAN CHUCKS

*A World Standard for Precision*

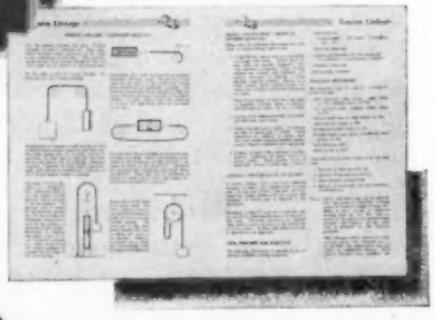
# machine designers:

*this informative engineering handbook can help you!*

If you design lift trucks, hoists, counterweight suspensions, controls, or any type of equipment where you must transmit pull or lift, this informative, free engineering handbook on tension linkages will help you!

It covers typical examples of tension linkage applications . . . helpful step-by-step data on equipment selection and examples to guide you in making your selections. There are tables of dimensional data and other important facts you'll find useful in your work.

Send for your free copy today. Just fill in and mail the coupon below. There is no obligation.



**BALDWIN·REX** *TENSION LINKAGES*

**BALDWIN-DUCKWORTH**
Division of Chain Belt Company
Springfield 2, Mass.

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Send me my copy of Bulletin No. 51-10 covering Tension Linkages.

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*Address*.....

*City*.....*State*.....

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## Hydraulic Steering Earthmoving Equipment

*(Continued from page 35)*

The balls constitute a thread between the worm and nut so that when the worm is turned the nut moves along the worm as with an ordinary screw thread. At the same time the balls roll freely between the worm and nut, so that screw motion is obtained with rolling instead of sliding contact between the parts.

Rugged rack teeth are cut in that portion of the nut which faces the Pitman shaft sector or output shaft. The rack teeth mesh with tapered teeth cut on one side of the Pitman shaft sector. The linear motion of the nut as the worm is turned is converted into rotary motion of the Pitman shaft sector or output shaft through these mating gear teeth.

The hydraulic power is applied to the Pitman shaft sector or output shaft through the meshing straight teeth on one side of the Pitman shaft and the piston rod rack. The flow of oil to the cylinder is directed by the control valve as described under the Euclid steer.

*Adapted from a paper presented at the Earthmoving Industry Conference, Central Illinois Section of the Society of Automotive Engineers, April, 1950. Part 2—Full Hydraulic Steer Systems will appear in an early issue.*

*Skinner* **stainless steel Solenoid Valves**

THREE WAY—Two Position—Normally Closed —Normally Open—Directional Flow
TWO WAY—Normally Closed and TWO WAY—Normally Open

* Skinner Solenoid Valves are only 2¾" high x 1⅜" dia., yet have large capacity within a standard range of 5 to 250 p.s.i. or special from 5 to 850 p.s.i. Progressive designers will like the accurate, long-lived, positive action, whether used for liquid or gaseous media. Skinner Valves have soft insert seats to prevent leakage—spring loaded for positive action—power consumption of 10 watts max.—usable in any position—pipe connections to suit your specifications—special coils for high humidity or high temperature applications can be supplied.

Standard models approved by Underwriters' Laboratories.

*Write for Bulletin No.* 501

**Skinner ELECTRIC VALVE DIV.**
THE SKINNER CHUCK COMPANY
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## PROGRESSIVE DISTRIBUTORS for INDUSTRIAL HYDRAULIC PRODUCTS

Nationally prominent manufacturer of a leading line of industrial hydraulic products still has a few select territories available for established distributors with a record of sales and service in this field. If you have one or more hydraulics sales engineers on your staff, and would like to make a permanent and profitable connection with an alert, promotion-minded manufacturing organization, please write and tell us about yourself. Your confidence will be respected.

**Address BOX 3151, care of this magazine.**

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5 BODY STYLES + SPRING RETURN or NO SPRING RETURN + 5 PIPE SIZES + 10 CONTROL ASSEMBLIES + NUMEROUS VARIATIONS = Thousands Upon Thousands of VALVAIR AIR CONTROL COMBINATIONS

Three body styles complete a line of 2-way, 3-way, and 4-way open-end exhaust, 3-way piped exhaust and 4-way piped exhaust valves, plus many methods of actuating, plus almost countless variations. Ends of all bodies in respective sizes are identical, permitting incorporation of any desired control assembly; internally, parts are interchangeable. Important features: leak-proof "O-U" packers (no metal seats); standard pipe area through valve permits unrestricted air flow and minimizes pressure loss. For controlling air, water or oil pressures up to 175 p.s.i.; temperatures up to 120° F. Sizes ¼", ⅜", ½", ¾", 1".

* * *

*For further information get Bulletin "A".*

* * *

**VALVAIR CORPORATION • 454 Morgan Avenue, Akron 11, Ohio**

**AFFILIATE: SINCLAIR-COLLINS VALVE CO.**

Rely Upon Valvair — 2-WAY 3-WAY 4-WAY

## Another Giant Industry uses FULFLO BY-PASS OIL RELIEF VALVES

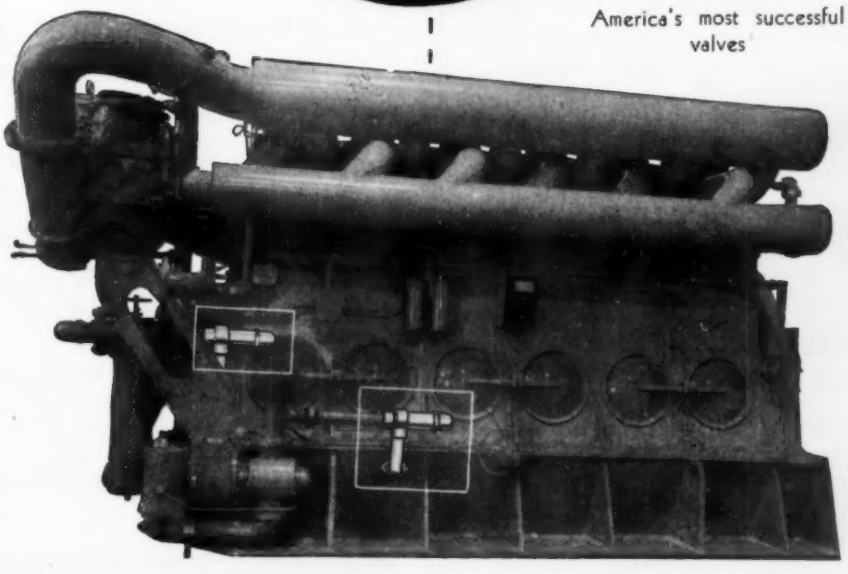
America's most successful valves

**THE BALDWIN LOCOMOTIVE CO.** is famous for its insistence on highest quality and efficiency in every detail.

Two FULFLO OIL-RELIEF VALVES are applied to the lubricating oil piping system of the 1000 hp supercharged Diesel engine in Baldwin Diesel Electric Locomotives.

For constant pressures . . .
NO MAINTENANCE . . .
CHATTERLESS.

*¼" to 2" standard pipe thread and STD 300 lb. American flange valves 1" to 2".*



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BLANCHESTER, OHIO

*WRITE NOW on your letterhead for FULFLO MECHANICAL DATA BOOK*

# POST SCRIPTS OF INDUSTRY

## NEWS · VIEWS · TRENDS

**Precision Rubber Products Corporation** announces the appointment of **Edward N. Cunningham** to its technical sales staff. Cunningham was a technical sales representative for the Rubber Division of Enjay Company, Inc. During his nine years with Enjay Company, he was closely associated with the early development of the Nitrile and Butyl types of synthetic rubbers, as well as with active field sales and market development work. Cunningham was also associated with the B. F. Goodrich Company for twelve years, where he did fundamental research.

E. N. Cunningham

**Frank Hallberg** has been appointed chief engineer of the **Ross Operating Valve Company,** 120 East Golden Gate, Detroit, Michigan, according to an announcement made by John Sainsbury, president. Hallberg has wide experience in the development of machine equipment and brings extensive knowledge of pneumatic and hydraulic applications to his position. He was previously connected with the Clinton Machine Company of Clinton, Mich. and was chief engineer of the Detroit Industrial Engineering Company.

Frank Hallberg

**Joe L. Lantz** has been appointed sales manager of the **Goshen Rubber Co., Inc.,** assuming those duties of that office formerly the responsibility of **Elmo E. Niccum.** Mr. Niccum will continue in his present capacity as president.

The **Eaton Screw Products Co.,** a screw machine plant in Eaton, Ohio has been purchased by **The Parker Appliance Company** for the exclusive manufacture of steel tube fittings for industrial hydraulic use. Parker has established the Synthetic Rubber Products

Whether you want to speed up your machines to increase production or slow them down to meet varying material conditions, you can do it easily and quickly with Lovejoy Variable Speed Pulleys . . . for new or old equipment. With fingertip control, you may adjust the speed of your equipment while it is in operation, without loss of time or labor. Lovejoy Variable Speed Pulleys are available from stock in sizes fractional to 8 H.P. Ratios to 3:1 infinitely variable.

*Send for catalog and complete information*

**LOVEJOY FLEXIBLE COUPLING CO.**

*Manufacturers of Lovejoy Variable Speed Transmissions*

5037 W. LAKE ST. · CHICAGO 44, ILLINOIS

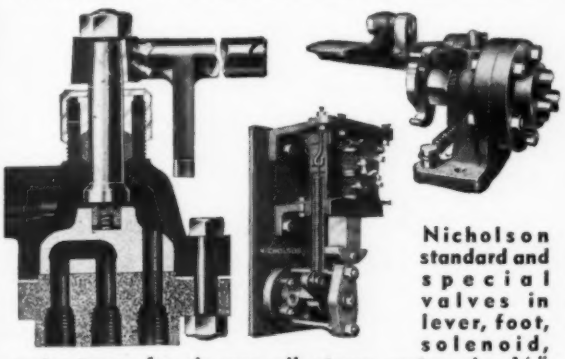
**Also Mfrs. Lovejoy Flexible Couplings and Lovejoy Universal Joints**

Circle 48 on Reader Service Card

## NICHOLSON CONTROL VALVES *feature*
# EASY MAINTENANCE

A survey of maintenance men shows 6 reasons for the increasing standardization on Nicholson cylinder control valves:

1) Specially treated hard seats that don't cut out.
2) Seating surfaces are protected from dirt and grit.
3) Metals, gaskets and gland packing to suit the service.
4) Generous stuffing box, easily repacked.
5) Heavy-bodied, take abuse.
6) Simplicity of design, minimizes maintenance time.



Nicholson standard and special valves in lever, foot, solenoid, motor types; for air, gas, oil, steam, water; size ¼" to 2½"; press. to 5000 lbs. CATALOG 546

**W. H. NICHOLSON & CO.** 213 Oregon St. Wilkes-Barre, Pa.

*Sales and Engineering Offices in All Principal Cities*

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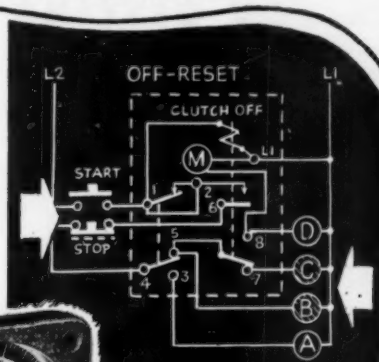
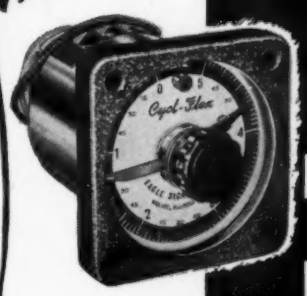
# *a new Timer*



Starts from momentary or maintained pilot switch.

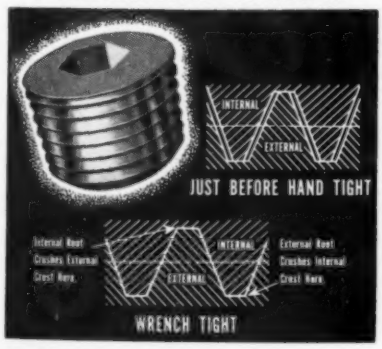
4 load circuit combinations are built in. Solves those difficult jobs without using complicated circuits.

**BULLETIN 120** will give you the full story

There's a wide selection of timing ranges. Enclosed mechanism seals out trouble.

**EAGLE SIGNAL CORPORATION** Moline, Illinois

# UNBRAKO
# DRYSEAL
## THREAD
## PRESSURE PLUG




## *SEALS TIGHT* WITHOUT COMPOUND

Unique thread design of UNBRAKO "DRYSEAL" Pressure Plugs provides positive sealing at both major and minor diameters of threads, preventing spiral leakage, even under extreme pressures. Full range of sizes from 1/16" to 1¼" N.P.T.F.

Write for Bulletin 675.

# —SPS—
**STANDARD PRESSED STEEL CO.**
JENKINTOWN 2, PENNSYLVANIA

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## AMERICA'S LARGEST PUMP MANUFACTURERS
*rely on*

**PROMET** THE Engineered BRONZE

**FOR HIGH QUALITY**

THRUST PLATES — BEARING PLATES
PRESSURE PLATES — BUSHINGS — SEALS
CONNECTING RODS

machined or rough cast and of the specific formula best suited to the application.

They take advantage of the attractive savings. They receive a

MONEY-BACK GUARANTEE OF LONGER SERVICE

Let us make recommendations and quote you. Simply send blueprints, conditions of operation and other data.

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## The AMERICAN CRUCIBLE PRODUCTS CO.
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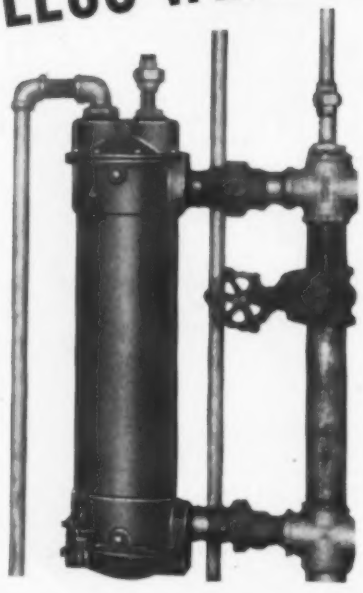
MORE COOLING WITH LESS WEIGHT?



YOUNG HEAT EXCHANGERS ARE SELECTIVELY ENGINEERED TO THE JOB . . . . . .

● Where compact, lightweight heat exchangers are important, it will pay to check the Young line. For example, the new A-800 shell and fixed tube bundle units through efficient design and precision manufacture offer equivalent heat transfer with up to 40% reduction in size and weight!

Let us prove these economies to you on your specific application. Incidentally, we believe you'll be pleasantly surprised at our prompt quotations, quick deliveries, and low first cost.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Heating, Cooling, and Air Conditioning Products for Home and Industry.

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YOUNG RADIATOR COMPANY
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Plants at Racine, Wisconsin and Mattoon, Illinois

DISCOVER FOR YOURSELF NEW HEAT TRANSFER ECONOMY

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Rush me the facts about your ☐ Fixed ☐ Removable Tube Bundle Heat Exchangers, without obligation.

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Company in Los Angeles for production of "O" rings and other molded products.

H. T. Hallowell, Jr.

Election of **H. Thomas Hallowell, Jr.** to the position of president heads the list of important management changes recently announced by **Standard Pressed Steel Co.**, Jenkintown, Pa. **H. T. Hallowell, Sr.**, becomes chairman of the board. Treasurer, **H. F. Gade** is given the additional title of senior vice president; **J. W. Friel**, present sales manager, takes the post of vice president in charge of sales. **William I. Kryder** succeeds Ralph S. Mast to the office of secretary.

Establishment of west coast regional headquarters at 733 East Pico Blvd., Los Angeles, has been announced by **The Bellows Co.**, Akron, Ohio. **George Cook**, formerly of Conapco, Inc. will act as west coast manager.

**Greer Hydraulics, Inc** has broken ground for the construction of a new plant adjoining its existing facilities at 454 Eighteenth Street, Brooklyn, N. Y. The new plant, expected to be in operation by May 15, will provide an additional 40,000 square feet of engineering, manufacturing and laboratory area and will double the present productive capacity of the company.

**Hanna Engineering Works** has appointed the **Industrial Air & Hydraulic Equipment Company**, 13306 Kercheval Ave., Detroit, as exclusive sales representative of Hanna products in Michigan.

10-DAY DELIVERY!

SIMPLEST... MOST COMPACT

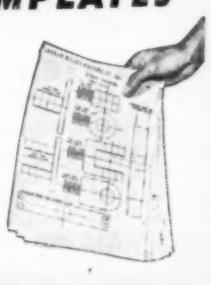
O-M

AIR HYDRAULIC WATER CYLINDERS

Add up these advantages. They are the reasons why more and more equipment manufacturers are specifying Ortman-Miller cylinders for all types of applications.
Simplicity of design eliminates tie rods and bulky end caps . . . saves one-third in installation space. All parts and mounting brackets interchangeable bore for bore. Cost less to buy, install and service. Full range of sizes (1½" to 8" bores) **available for early shipment.** Machined steel (no castings) and bearing bronze throughout.
*Write today for details! Speed production, cut costs and save space with Ortman-Miller cylinders.*

FREE TEMPLATES

**For the first time in the industry, O-M offers a complete set of templates showing all cylinders and mounting brackets. ½ scale. Your set on request.**



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MACHINE CO., INC.

1204 150th Street, Hammond, Indiana

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## Another Job for Pesco HYDRAULIC MUSCLES

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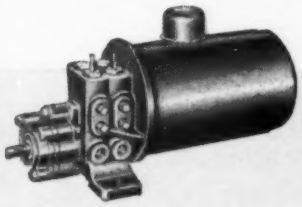

Pesco Hydraulic Power package model 05-2252-010. Pump displacement .433 cu. in. Capacity 2.75 g. p. m. @ 1600 r. p. m. @ 1200 p. s. i. Package includes relief valves, check valves, and reservoir.

# PESCO POWER PACKAGE operates BOTH Hydraulic Header Lift and Variable Speed Drive on Deluxe COCKSHUTT Combine

Offering a new range in performance, never before equalled in combine design, the new Deluxe Cockshutt "Drive-o-matic" combine makes possible great savings in threshing time and a much greater yield in grain threshed.

By designing the combine so that a single unit Pesco hydraulic Power Package provides the necessary power for both lowering and raising the combine header, to compensate for variations in crop heights and ground levels, and for regulating the forward speed of the combine itself, Cockshutt engineers have made it possible for the operator to meet all harvesting conditions with finger tip control.

The preciseness, ease, and accuracy with which Pesco hydraulic muscles can handle such complicated, heavy, and sometimes awkward operations, is only one important reason why more and more farm and industrial equipment manufacturers are turning to Pesco for answers to their hydraulic power problems.

Perhaps this sales power of Pesco hydraulic power can help you, too. For the complete story, write today.

engineering Pesco production

**PRODUCTS DIVISION**

**BORG-WARNER CORPORATION**

24700 NORTH MILES ROAD BEDFORD, OHIO

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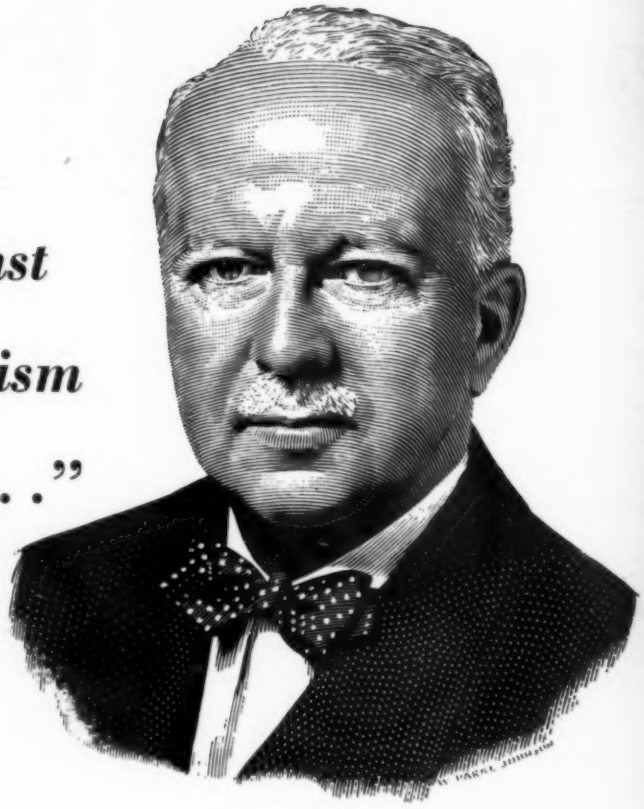
*"The immunizer against the disease of communism is a certain feeling . . ."*



**MR. WALTER S. GIFFORD**

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In 1938, A. T. & T. employees were offered a Payroll Savings Plan for the purchase of U. S. Savings Bonds. To date, Bell System employees have invested ***more than half a billion*** dollars in savings bonds—with a maturity value in excess of $675,000,000.

In upwards of 21,000 large companies, more than 8 million Americans are investing $150,000,000 in U. S. Savings Bonds ***every month.*** To the systematic saving of these men and women—and the whole-hearted co-operation of executives like Mr. Gifford—is due in no small measure the important feeling of ownership shared by the Americans who own 56 billion dollars in U. S. Savings Bonds (against 45 billions at the end of the war!).

Every Payroll Savings Plan is a reflection of the vision and enthusiasm of the top executive of the company. If he gets behind it, ***personally,*** employee participation is high—to the benefit of the country, the company and the employee. If the interest of the Big Boss is active—participation may very well exceed the 50% mark. The top man is the key man in a Payroll Savings Plan.

Get in touch with your State Director, Savings Bond Division, U. S. Treasury Department. He will help you put in a plan . . . or he will show you how to increase employee participation—without undue effort or high pressure tactics.

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